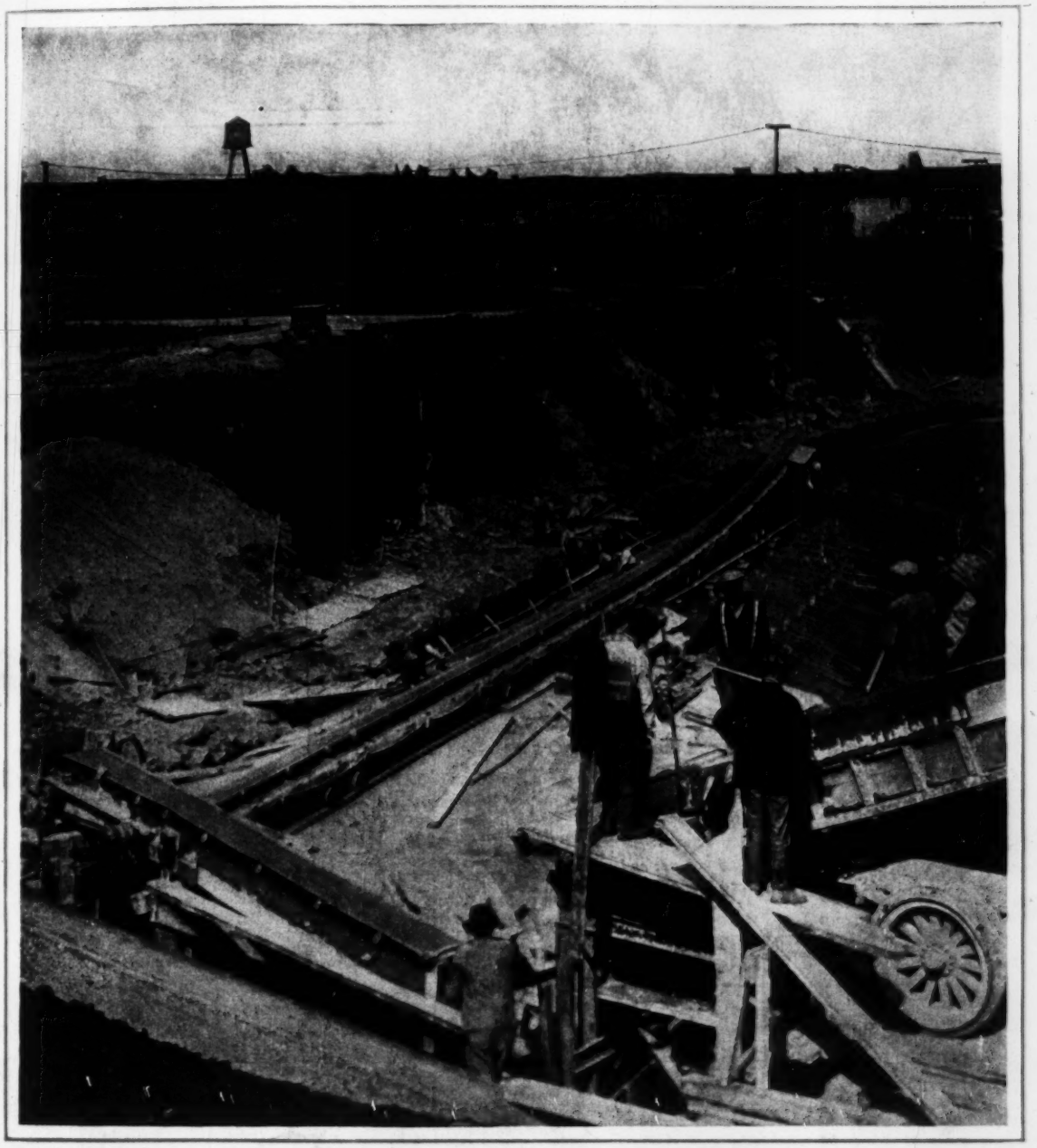
Devoted to Civil Engineering and Contracting

January 22, 1925

McGraw-Hill Company, Inc.

JAN 24 1925

Engineering News-Record



Handling Concrete With Belt Conveyor in Buffalo, New York

The Water Department as a Self-Controlled Utility, by V. Bernard Siems—Railway Signalling Methods for Public Roads, by Lewis E. Moore—Belt Conveyor Handles Concrete for Large Aqueduct—Staff Report of Associated General Contractors' Convention

No other roof can be *Worth* as much

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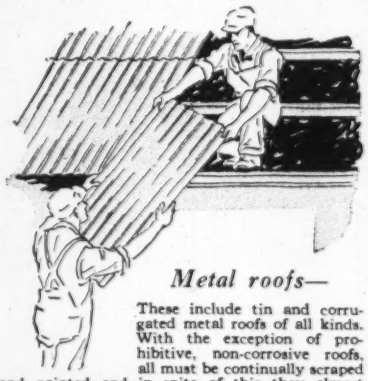
This includes tar or asphalt and composition coverings. None of these roofs are fireproof—all require periodic recovering, painting and frequent repairs—all are short lived and greatly increase insurance rates. Half of all fires start or spread on the wood roof—and fire insurance does not cover interrupted production.



Metal roofs—

These include tin and corrugated metal roofs of all kinds. With the exception of prohibitive, non-corrosive roofs, all must be continually scraped and painted and in spite of this they almost invariably rust out in the joints and from underneath. Moreover, temperature changes open joints, cause rust, and excessive repairs.

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ENR1-22J-BTG

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ENGINEERING NEWS-RECORD

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DEVOTED TO CIVIL ENGINEERING AND CONTRACTING

FRANK C. WIGHT
Editor

Volume 94 NEW YORK, JANUARY 22, 1925 Number 4

In Time of Peace

HOW much preparation for war is desirable will always be a moot question. Between the undesirable extremes of complete ignoring of the possibility of conflict and so intensive a preparation as to provoke the desire to try out the machinery devised there must be a sane ordering of public mechanism and private thought which will provide preparation without provocation. The National Defense Act under which the War Department now functions attempts this middle ground. Under it the Army must originate and keep up to date war plans for a possible emergency. In carrying out this instruction the General Staff has profited by the hysteria of 1917, and is calling in conference the various industries, which, as the World War progressed, were found to be as important to victory as the armed troops themselves. Last week it was construction's turn and while the representatives of the various technical associations who met at Washington did not do more than to learn what the department is trying to do, there was set up a mutuality of interest and good feeling which will serve in the future to make the planning task of the Army easier and more promising of effective result.

Efficient Budgeting

THE federal budget is just beginning to function effectively. At first its director had a hard time convincing Washington that it was a serious attempt to put government expenditure on a business basis, but General Dawes managed, before he turned over his office to his equally efficient successor, General Lord, to make it clear that at last there was some one sitting in high place who could conceive of estimates and appropriations on something better than the bluff policy which had prevailed for so many years. The present director is exceptionally fortunate in having as the chief executive of the country a man whose ideas of public expenditure are so well known. General Lord is doubly armed when he refuses to approve an estimate, for he knows that the Vermont thrift which pervades national economic thinking in Washington today would much rather save a nickel than to spend it. Last week at the dinner of the American Engineering Council, General Lord eloquently defended the operation of his office. He appealed to his hearers as stockholders in the biggest company in the world to back him up in attempting to save the company money, but Secretary Hoover, who was present at the dinner, put his finger on the one weak spot in the budget operation and in a too pervasive theory of economy. Mr. Hoover asked the director of the budget to recognize the difference between productive and non-productive government service. Only one hundred million of the three billion of this year's appropriations, the Secretary said, go to what might be reasonably termed productive service, less than 4 per cent, and yet the estimate cutting plays few favorites. In time the budget department is going to discover the distinction between the productive and non-productive activities of government and when it does the distribution of expenditure will become more efficient and we will begin to reach that desirable analogy to good business wherein some of the business money is put back to insure future growth.

Construction Fact Finding

FACT FINDING has been laid down more definitely during the past year as a leading purpose of the Associated General Contractors. At the executive committee meeting in Des Moines last fall a revolving fund was created to be known as the Construction Foundation and to be used for "assembling original data pertaining to construction." Last week in Washington at the annual meeting of the association the committees on construction and on methods specifically urged the accumulation of cost data and other determined facts respecting force account construction and winter operation. Not the least urgent request by Secretary Hoover for service from the association was that comparative data on force account and contract construction of public works be collected. We speak within our knowledge when we say that the directing officers of the A.G.C. would welcome no task more than that of complete fact-finding studies of force account work, and of winter construction. Also we are within our knowledge when we announce that there is but scant opportunity for such research with the present curtailed budget of association expenditures. The present Construction Foundation fund was made possible only by personal contributions by members. If any considerable research is to go ahead along these other lines not already laid down for using the Foundation fund this research must be financed by subscriptions. In this activity the branches of the construction industry other than contracting should participate. They have quite as much to gain as has contracting.

Another Try at Bonding Reform

IT IS an occasion for congratulations, we think, that the action of the Associated General Contractors as expressed in the resolution on corporate contract bonding practice published elsewhere in this issue, leaves the way open for continued negotiations. There can be no mistake in the resolution adopted of the determination of the contractors to force reform. No less violent action could have been anticipated. It is indeed a little surprising, with knowledge of the full measure of their exasperation over existing conditions, that the door was not completely closed by the contractors against further effort by amicable methods to arrive at a settlement with the surety interests. The surety interests have expressed a desire to confer further and to include the national engineering societies in the conference. There can be no objection. In fact it may offer an opportunity

to these national organizations to contribute substantially to the solution of one of the most provoking problems which faces public works construction. Both the organized engineers and the contractors should make one more try at this difficult job of reform.

Temporary Relief from Fire

A FIRE a week or so ago in a Boston hospital, in which one bed-ridden patient lost her life, brings to the fore again the problem of protecting such institutions against fire. After every such calamity there is immediate public clamor for replacing of the institutional firetraps, a clamor which in most cases soon dies out or is satisfied by moves toward large appropriations or bond issues for complete rebuilding, which rarely come to fruition. Public authorities seem to be singularly loath to recognize that in most of such institutions temporary measures of relief can be provided for comparatively small sums and in short time. In New York City, for instance, a report was made as long ago as 1916 by H. F. J. Porter and A. L. A. Himmelwright, two engineers, submitting methods of alteration, mainly by new fire walls, horizontal exits and special bed castors, which if carried out would immeasurably add to the safety of more-or-less helpless inmates of such institutions. Some of these repairs were made, but for the most part the recommendations were neglected even after the horrible fire in 1923 in the State Asylum at Ward's Island. Today the city is being urged by some public spirited citizens to spend upward of $25,000,000 on new institutions in which inmates will be relatively safe from fire. Possibly the city has that much to spend now, but if it has not how much better it would be to spend a small fraction of that in reconstructions which would at least permit removal of patients even if the building itself were destroyed by fire.

Water Department Independence

THE case for making the water-works of a city virtually independent of the city government has never been so strongly put, as far as we know, as in the brief prepared for the Baltimore Water Board by its water engineer and president. The brief, which is printed nearly in full elsewhere in this issue, is the more interesting because it is aimed against a plan to consolidate the engineering services of Baltimore in a department of public works divided into eleven bureaus, a plan proposed by the Committee on Economy and Efficiency some months ago and approved in general terms at the November election. Interest in the plan is still further heightened by the fact that it runs counter to both the theory and practice underlying hundreds of charters and charter amendments adopted within the present century—centralization of power and responsibility, brought about in part by the abolition of independent and interdependent governing bodies.

The water board in America has been and still is much in evidence. On the whole it has an honorable record, especially in comparison with other branches of the municipal service. Nevertheless, it has been largely a creature of circumstances peculiar to American misgovernment. Under a changed and what many believe to be a clearer conception of the functions and methods of municipal government the water board is disappearing—not so fast as other and less justifiable and more haphazard boards and departments, but it is on the wane.

The growth of water boards was due chiefly to fear of (1) dishonesty and (2) ignorance and inefficiency of mayors and councils. The voters, instead of putting men of greater integrity and capacity in control of city affairs tried to meet the situation by authorizing the same mistrusted officials to appoint still other sets of men to build and operate water-works in the apparent belief that "business man" or "men of affairs" would fill the need and would be appointed—as sometimes they were.

The failure was to recognize that what is needed to make a water department efficient is not a board but engineers and other administrative officers qualified by education, experience and temperament to direct the performance of the work in hand. Centralization of the appointment of these and other administrative officials in a single official held responsible for one entire administrative service instead of divided responsibility is one of the most notable features of municipal government during the past decade.

Coming now to the Baltimore brief for a water board: It rests largely on what for brevity may be termed the public utility theory, supported by court declarations that when a city operates a water-works plant it is engaged in a commercial enterprise. From these declarations—made by the courts with no reference whatever to water-works administration—it is argued that a water board is a logical requirement corresponding in function and in fulness of authority with the board of directors of a utility company. There are several reasons why the utility-directors analogy does not hold good: (1) Company directors are chosen by the shareholders, nominally, but they are really picked by the holders of the majority of the stock, even if a single person, and are, in effect, liable to majority stockholder dictation. (2) Company directors are in charge of an entity; members of a water board, however much of an entity a water-works plant is from some of the viewpoints of the brief, are in control of only a part of the affairs of a city. (3) Only a minority of the water board members under the proposed Baltimore plan are chosen by the people whom they are supposed to represent; the majority are appointed by the mayor, subject to confirmation by the council, in accord with the old checks and balances theory. (4) To complete the public utility analogy, on its financial side, the liabilities of the water-works—bonds and other indebtedness—would be secured by the water-works property only whereas, unless Baltimore stands alone, the entire credit of the city is pledged to the water-works liabilities.

That the public utility analogy is an argument of considerable strength, and probably the strangest that can be advanced for an independent water board, most persons competent to express an opinion would probably agree; but few close students of municipal government would say that a municipally-owned water-works plant should be under no other control by the city government as a whole than the very slight and uncertain control that comes because a minority of its members are elected by the people—with their ex-officio membership on the water board an incidental consideration at best—while a majority of the members are appointed by the mayor and confirmed by council—or representation once removed.

If the desire is to give the voters of a city a water board analogous in choice to company directors, then

they should be subject to popular election—which we do not advocate.

Although there is no universal hard-and-fast rule on the subject, since a variety of local conditions and preferences may deserve weight in each case, the consensus of opinion among students of municipal government today stands for centralized municipal government, with a council or commission responsible for legislation and that only, on the one hand, while on the other hand the opinion is just as strong for centralized administration, with no power over legislation, and with single-headed departments and bureaus rather than boards, which latter are not needed or fitted for executive service.

It is only fair to say that among those whose ideas deserve consideration there are a considerable number who believe in administrative boards, and presumably these would put water-works first among the services which they would like to see thus administered.

One or two minor points in the brief need mention. The unwillingness of two private utilities at Baltimore to merge into one is at least offset by the recent merger of the gas, electric light and street railway companies that supply a large part of New Jersey. The general practice in commission-manager cities is to combine two or more municipally-owned utilities in a utilities department, which seems to be at least as much against each utility standing alone as it is against putting utilities in public works departments. Some of the essentials of good water-works service mentioned in the Baltimore brief seem quite as readily if not more easily fulfilled under a department of public works than under a water board.

Finally, given an alert and intelligent public opinion, efficient water-works service may doubtless be had under either of the plans proposed for Baltimore. The questions are, which will make for the most efficient municipal service at large in any city and, once exceptions are made to let this or that department be independent of the city government as a whole, where is a stop to be made?

Speeding Up Construction

A QUICKENED sense of time values is an outstanding element of modern construction thought. This attribute has not developed in a single year, but the past year, by special accomplishment, marks a stride in growth which forces the mind to range back and pick out the contributing agencies. This quickened sense is indicated both by specific exemplification of fast building and by conscious effort to improve the agencies for utilizing more time and for working faster. It is the specific examples perhaps which appear most prominent and they are indeed worth notice. Three of them only need be mentioned; the Bear Mountain Bridge, the Saguenay River power plant and the Holland Tunnel. Notable, however, as each of these great works is for rapid construction this in each case was consequent upon simplification, winter work and other fundamental processes for conserving time.

In the Bear Mountain Bridge we have a structure equivalent to the famous Brooklyn Bridge completed in 18 months. The Holland Tunnel, two 29½-ft. tubes 6,881 ft. long, is holed through in 30 months. The Saguenay River hydro-electric plant calling for 500,000 cu.yd. of concrete and some 325,000 cu.yd. of excavation in half a score of structures will be completed in 30 months. Practical constructors will appreciate the continuous speed which these figures indicate. They are not isolated examples. They express the sublimation of time values in construction.

What are the agencies which have made such accomplishment practicable? There are many and some of them are inextricably inter-related but the principal one stands out distinctly enough to be indicated.

Outstanding, of course, is winter construction or more correctly year-around construction. With the exception of paved road work, there are few major construction operations today which do not proceed as actively in winter as in summer if there is any reasonable warrant for continuous construction. Designed construction plant, too, has been a major help. In greater numbers than ever construction plants today are being designed and not merely assembled. By design is considered arrangement with respect to access of materials, job transportation, center of gravity of work and controlling operation as well as equipment selection and co-ordination and capacity.

But one of the most notable advances in construction plant design contributing to speedier building has been the improvement in job transportation. On most recent operations this has developed into a system of mechanical distribution as distinguished from an assemblage of hauling units. These systems range from the 35 miles of standard-gage railway reaching every operation on the Saguenay power development to the network of belt conveyors which handled concrete for the new New Jersey plant of the Western Electric Co. These examples are not exceptional—as many others as there are well handled large operations might be named. In general in job haulage, transportation systems are replacing odd collections of hauling units. These systems are of every sort, the point being that they are arranged systems and not any predominant method.

Another change in plant equipment of construction operations is the more thorough or complete substitution of machines for hand processes. This has brought about some enormous installations for single operations—outfits costing one or two million dollars. More complete plant equipment of construction work, and particularly large equipment outfits, have developed the contractor's repair plant and central power supply. The shops on some large operations are virtually equipment factories. For central power distribution electricity and compressed air are supreme. One goes onto few large construction operations where many of the equipment units have individual power generation, and on the others gasoline is replacing steam, the evident effort everywhere being to eliminate distributed and cumbersome fuel service and attendance wherever possible.

These are the more important of the physical factors that are producing faster construction work. They are only the outward indication of the inner feeling of the engineer and the contractor, but more particular the latter, that time is money and that spirit is prevalent in less tangible form on all construction work as it never has been before. The visible evidences and the spirit itself are together responsible for a growing construction efficiency.

Railway Signaling Methods for Public Roads

Types of Signals—Color of Lights—Tail and Stop Lights—Location of Signals—Intersection Warnings—Crossing Protection—Maintenance—Vision of Comprehension

By Lewis E. Moore
Consulting Engineer, Boston, Mass.

The author of this article was from 1914 to 1921, with the exception of about two years in the army, Bridge and Signal Engineer of the Massachusetts Public Utilities Commission. His duties required him to pass upon many signal layouts, both for steam and street railways. It so happened that no two of the steam railroads with which he dealt had the same system of signals, and some of them had two or more systems in use, so that he can fairly claim to have had a reasonably broad experience in the subject and to write from the standpoint of a signal engineer. In the course of business he also drives a car about fifteen thousand miles a year and so perhaps can present the viewpoint of the motorist at least to some extent. —Editor.

IN DECIDING on the adoption of systems of signals for traffic control on the highways, little, if any, attention has been paid to the many years of experience and experiment which have evolved the present system of railroad signals. Colored lights are used indiscriminately for almost any kind of an indication, and in the same city the same color of light means different things in different places. This article is an attempt to set forth some of the results of experience with railroad signals and to offer concrete suggestions looking toward their adaptation to the standardization of highway signals and their locations.

Types of Signals—The general trend seems to be toward light signals rather than any type of semaphore. The writer believes that the light signal is the correct one to use because the indication is the same by day and by night, and also because it is more easily distinguished from its background than any semaphore, particularly in cities. As it has no moving parts, except the switches or relays which actuate it, it is more durable and may be cheaper than the semaphore. Only light signals will be considered in this article.

Color of Lights—After many years of experience and evolution the steam railroads have arrived almost universally at the following system:

Red indicates *danger, stop.*

Yellow indicates *caution,* or proceed slowly and with care. (It also indicates that the next signal is red, or danger. This use as a "distant" signal has no particular interest in connection with highway traffic.)

Green indicates *safety,* proceed as fast as is permissible under other governing circumstances.

This is a simple and easy combination to remember and is easy for the average motorist to comprehend, particularly as a red light universally means stop, or danger, and is so understood by everyone, even women and children.

These three colors should be adhered to as they have been determined upon by the railroads after exhaustive experiment and experience as being in general the most distinctive, as well as the most visible under adverse atmospheric conditions.

Generally speaking, only one light at a time should be used. Where it seems essential to indicate right- or left-hand turns on the signal, it can best be done by using two staggered yellow lights, as shown in Fig. 7. As a rule this indication will be needed only for left-hand turns, as right-hand turns can nearly always be made. As a matter of fact where the traffic is so heavy as to require the use of signals, it is far better to allow no left-hand turns. Motorists, desiring to make left hand turns can always turn to the right and run around the block or else turn around on the side street and come back, making a right-angle crossing in either case.

Signal systems should universally use the above colors and indications. Other colors and indications may be apparently all right after people are trained in their use and know what to expect, but to the stranger within the gates, who is becoming more and more common, it is very confusing to have one system in one city and another system in another city.

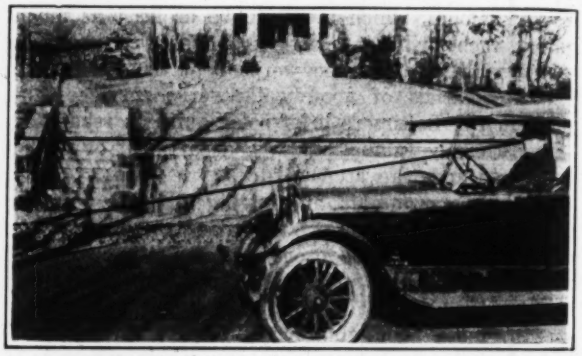
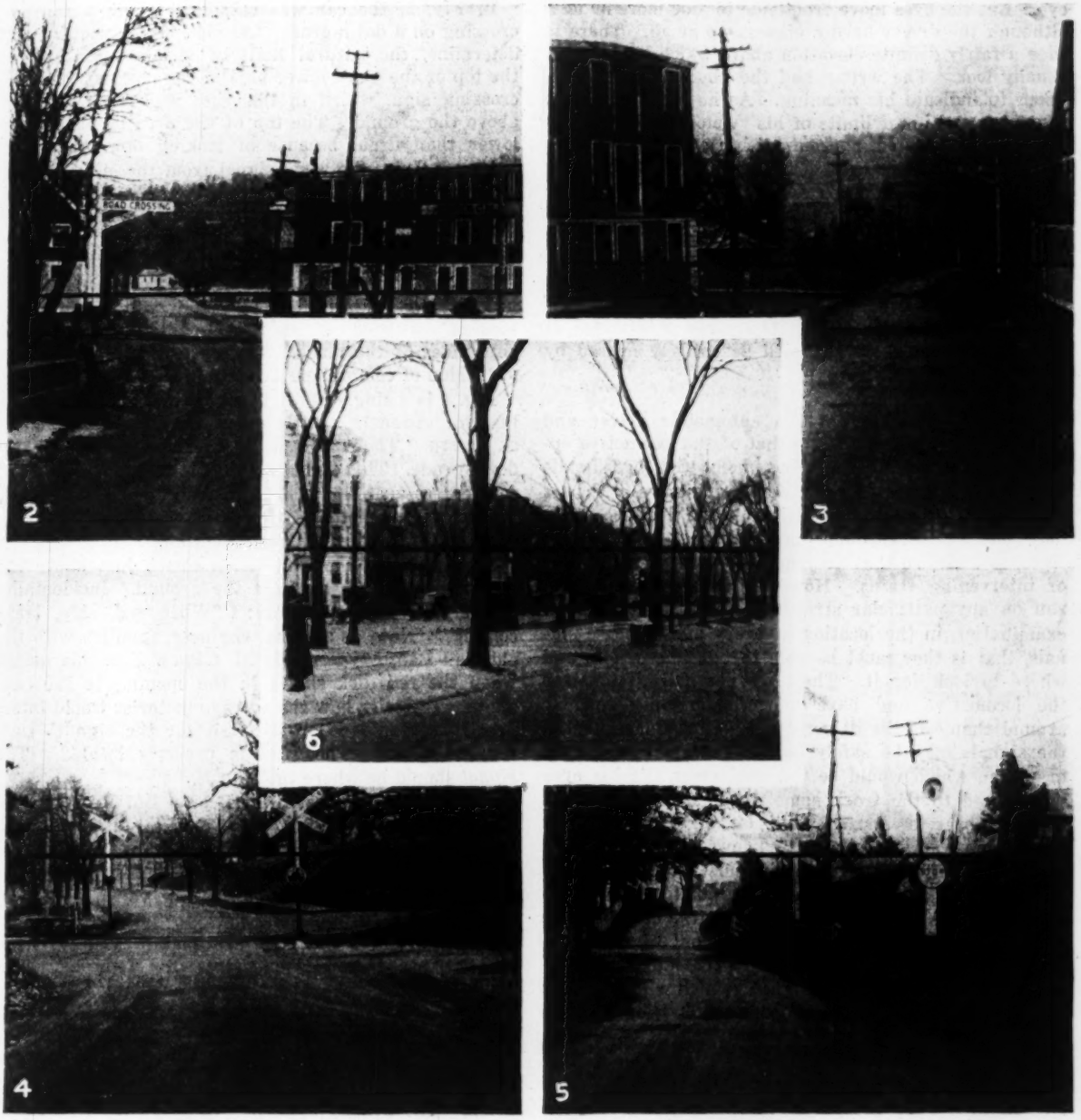


FIG. 1—"VISION OF COMPREHENSION" OF DRIVER
A signal to be surely noticed by the driver must come within the area of the angular opening.

Tail and Stop Lights—It is universal practice to use red lights for marking the rear ends of trains and it is the logical and correct color to use for the tail light of an automobile. Its meaning may be interpreted to be "stop short of here." The so-called "stop light," which is lit automatically when the brakes are applied, is perhaps not quite so simple. There seems to be a tendency toward the use of yellow. Perhaps this is as good an indication as any, it means "caution" and the red tail light is already on the car, meaning "stop short of here." Where there are two stop lights used, the one which is lit when the brake is lightly applied should be yellow and the one which is lit when the brake is fully applied should be red.

Stop lights and tail lights should be separated from each other a foot or so. When the lenses are in the same case they are too close together. Red and yellow, when the lenses are in contact, are not distinctive. They blend and the light with the weaker bulb is "smothered" or made indistinct. It is a good plan to connect the stop light through the ammeter as it is easy

to tell whether the light is working or not by applying the brake slightly and watching the ammeter needle. If it flickers as the brake is applied, the light is working. The writer has gone a step farther with his own stop light and connected it on the distributor side of the ignition switch. The light is then automatically connected only when the engine is running.



FIGS. 2-6—THREE EXAMPLES OF SIGNALS NOT WITHIN AND TWO OF SIGNALS WITHIN "VISION OF COMPREHENSION"

Fig. 2—Looking down hill toward railroad crossing. Objects above the horizontal line are not readily seen.

Fig. 3—Looking up hill from opposite side of crossing.

Fig. 4—Signal located within vision of comprehension.

Fig. 5—Sign within and signal outside vision of comprehension.

Fig. 6—Ideally located and lighted signal.

Locations for Signals—There is one matter in connection with signals in general which the writer has never seen advanced in print, and that is that a signal in order to be readily apprehended, particularly by a stranger, must be located so that it will come within what the writer calls for want of a better term, the range of his "vision of comprehension." To explain what is meant we will say that a driver's eyes ordinarily focus on the road at a distance of one to two hundred feet ahead. He is aware, of course, that there are trees and a sky and some fields, and perhaps some houses around the edges of his vision, but things outside of a certain area between himself and the point on which his eyes are focused are not clearly visible and do not produce much impression upon the eye and the brain. The writer experimented a little to try to determine at what height from the road everything was clearly visible at the side of the road a little distance ahead, and concluded that under ordinary circumstances, riding through the country, not much notice was taken of any objects more than seven or eight feet above the level of the road. This conclusion is more or less approximate; the height might vary somewhat with different individuals.

The area of the "vision of comprehension" is all included beneath this elevation some seven or eight feet above the road. If the eye were fixed this area would be the cross-section of a cone having its apex at the eye. But the eyes move from side to side more or less, although the driver hardly glances *up* at all. There is then a fairly definite elevation above which he does not usually look. The writer had the photograph, Fig. 1, taken to indicate his meaning. As he sits in the car, the upper and lower limits of his "vision of comprehension" are indicated approximately by the two lines diverging from his eyes. The more important upper limit was located with greater care than the lower one and is very nearly horizontal. A signal to be surely noticed by the driver, particularly on a strange road, must come *within this area of "vision of comprehension";* in other words, it must obtrude itself sufficiently on the driver's eye and mind so that he will realize that he is receiving a signal. If outside of this area, it is probable that the signal will be entirely missed by the driver.

Visibility—The case of the automobile driver and signals is very different from that of the locomotive engineer and signals. It must be remembered that signals on railroads are located a considerable distance in the air in order that they may be visible a long distance away, may have a background, preferably of sky, behind them, and also so that they may be seen over the tops of intervening trains. However, the enginemen who run on any particular stretch of track must pass an examination in the location of every one of these signals, that is they must be able to tell where it is and where to look for it. They are not obliged to steer the locomotive and have more opportunity to look around than has the driver of an auto. Consequently, the signals may be safely located outside of the area of vision, which would be the engineman's if his eyes were glued to the track some distance ahead. When running over a strange division an engineman is required to carry a pilot who knows it, and in order to qualify on that division he must run sufficiently with the pilot so that he can pass a qualification examination on the signals. Any such course of procedure for a motorist is, of course, utterly out of the question. It seems reasonable then to come to some universal standard location of signals, which will be within the limits of the area of the driver's "vision of comprehension."

Illustration of Signal Locations—Figs. 2 to 5 were taken more or less at random during a drive around Boston and were chosen as illustrating the writer's point with regard to the area of the "vision of comprehension." They are not arguments for or against any of the types of signals illustrated. On all of these pictures a line has been drawn horizontally above which objects were not readily seen when driving along the road.

In looking at these views the reader must remember that he is not at the moment driving a car. He is seeing all that the *camera saw.* The driver actually did not see as much as the camera, his vision being confined to the area above mentioned. What the driver saw *with comprehension* was beneath the horizontal line. No attempt has been made to delineate the side limits or lower limit of his vision, merely the upper limit. If the reader will lay a piece of paper across the printed page with its lower edge on the line, he will have left a picture of what the driver saw in part, his vision having been more or less indistinct around the sides and lower edge.

In Fig. 2, the car was standing facing a railroad crossing on a down-grade. As near as the writer could determine, the natural limit of vision was about at the top of the black lower part of the pole carrying the crossing sign, which in this case was some five feet above the ground. The top of the area of vision was lower than usual because of looking down-grade.

Fig. 3 shows the same signal from the other side of the crossing, it being up-grade from the crossing in this case, and the limit of vision being about at the top of the casing on the signal pole, some seven feet above the ground. This signal is neither within the area of "vision of comprehension" nor anywhere near it. It is located as high as it is so that it will be above the tops of cars and so one signal will be visible from both sides of the track. To locate it within the area of "vision of comprehension" would require two signals.

Fig. 4 is a single red light signal and in this case the limit of vision is a little above the top of the signal, as shown. The approach to the crossing is slightly down-grade. This signal appears to be properly located for correct visibility and for obtruding itself upon the vision of the motorist; in other words it is within the area of "vision of comprehension."

In Fig. 5 the limit of vision comes just above the sign and about 7½ ft. from the ground. Incidentally, this sign reads as follows: "When red, stop, train coming." Now, as a signal engineer, familiar with the old Hall Banjo type of signal, I know that this means when the red disk shows in the opening in the case above. I wonder how the average motorist would interpret it? Would he or she wait for the sign to turn red, or what? The *sign* is properly located. The *signal* should be where the sign is.

A traffic signal located on Beacon St., Brookline, in which correct signaling principles are used is illustrated in Fig. 6. Green is used to indicate proceed, red to indicate stop, and yellow to indicate that the light is changing from green to red, or vice versa, giving an appreciable time for motorists to prepare to start or to stop. These lights are plainly visible for a considerable distance, some three or four blocks in bright daylight, are about seven or eight feet above the street and are within the area of "vision of comprehension." In this particular place the signal is handled from a small sentry box on the sidewalk and there is also a bell which rings while the yellow light is on. The bell in this connection is entirely useless and only serves as an annoyance to abutting property owners and an additional expense both for installation and maintenance. The light is sufficient in itself. The yellow light, indicating caution, shows in all directions when the traffic officer is not on duty.

Highway Intersections—The so-called silent policeman has a variety of lights, sometimes red, sometimes green, sometimes yellow, and occasionally white. The silent policeman, if used at all, should be used to mark a place where caution is necessary. It should have a yellow light only on it, never green or red. Incidentally, the silent policeman is often so installed that it becomes in itself a "menace to navigation" and may make a roadway more dangerous than it would be

without it. It is a positive danger when installed in the middle of the crossing of two 20-ft. roads.

Proper signaling in such a case would call for the installation of a yellow light 75 ft. from the crossing on each of the approaching streets. A leaf might be taken here from the railroad practice. A yellow light is used on the railroad to mark the commencement of a place where slow speed is necessary and a green light marks the end of that place. A yellow light 75 ft. from a highway intersection would mean "run slowly until you reach the green light." The green light would be located beyond the intersection and would indicate "resume speed." This scheme could be extended to the marking of dangerous curves and grades. It is quite desirable to use the green light to mark the end of the slow-speed section in order to expedite traffic. Also, it would operate favorably on the psychology of the driver. If he knew that not only the *beginning*, but the *end* of a dangerous section would be marked he would be able to obey the signal more intelligently and also would be far more likely to heed it.

Railroad Grade Crossings—The seriousness of this problem is recognized everywhere and the writer has no idea that he is offering here a panacea which will prevent accidents.

He believes that a crossing bell is useless because it cannot be heard above the sound of an automobile engine, as a general thing, until the driver is just passing the bell, and then it is probably too late to do anything if the bell is ringing.

The plain, single light with an 8- or 10-in. lens is probably the cheapest form of crossing protection that can be used as it requires the least amount of operating mechanism. To locate the lights within the area of the "vision of comprehension" requires two signals at every crossing, one on each side of the railroad track.

Any piece of mechanism that was ever invented or built will fail at some time or other. A very large percentage of the time and thought that have been expended on signals has been to make their construction such that they will indicate danger whenever anything goes wrong with the mechanism. Now, of course, signal lights will go out occasionally. The railroads, therefore, provide that a signal light that is not lit is a danger indication and, according to the rules, an engineman must stop even though he knows from other indications that the signal should be clear. A negative indication, that is to say, one that means safety when there is no light lit, is not tolerated any more on the railroads in this country. Why should it be tolerated any more readily at the grade crossings?

It would seem that the proper indication at the crossing would be for each signal to have two lights, only one being lit at any time. One of them, the stop signal, should be red, and the other one yellow, meaning proceed with caution, so that the motorist would always get a positive indication at every crossing. The yellow light would show when there was no train approaching. The red light would indicate an approaching train. Of course if the light were out the stranger might be misled, but the regular user of the highway would be warned by the absence of the light and could govern himself accordingly. Incidentally, the regular traveler knows when the regular trains are due. He is caught more often than the public has any idea of by the extra train or the regular train running late. Perhaps there should also be a smaller lens showing up and down the railroad track so that an engineman approaching a grade crossing will see a green light, providing the red light is showing against the highway, and a red light, if it is not showing. This in order to provide as far as possible against failures of the mechanism being unnoted for too long a time because it is a locomotive engineer's business to report any signal which is out of order. This may add a little bit to the burdens of the engineman, but I believe most of them would rather know that the crossing signals are working than to be obliged to wonder for some exceedingly long moments whether the engine of the car his train has just hit will skid the train off the track before he can stop.

Maintenance of Signals—The maintenance of automatic grade crossing signals, of course, at once comes up. They require a considerable amount of expert care. Generally speaking, there is no one connected with any of the cities or towns who has sufficient knowledge and experience to maintain such signals properly. Also, because of the track circuit, it is necessary to enter on the property of the railroad in order to maintain them, which could not be allowed

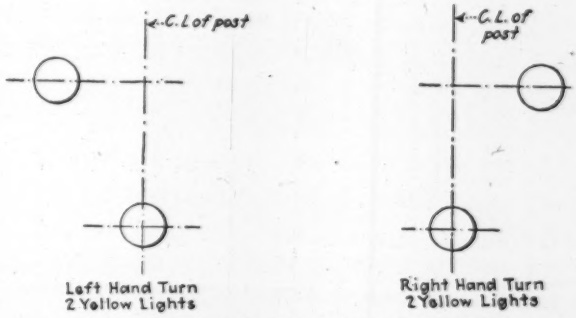


FIG. 7—LIGHT LOCATION INDICATES RIGHT OR LEFT TURN

as it would interfere with the railroad's own signal system. It is obvious then that the maintenance of such signals should be in the hands of the railroads only, both because where there is a signal system on the railroad the two must be interconnected and also because the railroad has the expert help and facilities for maintenance.

The question of who shall pay the cost is another matter. To adjudicate this would require the wisdom of Solomon, to which the writer does not pretend, but he does offer the following suggestion based on his belief that the railroads should not be saddled with further burdens in the way of expense for the protection of their greatest competitor.

The installation and maintenance of the signals should be in the hands of the railroad, and at the expense of the body which maintains the surface of the highway on either side of the crossing. The cost of maintenance should be adjusted at so much per annum, depending upon the surrounding conditions, such as whether the railroad is signaled or not. If the railroad is signaled, the maintenance could probably be added to the duties of the maintainer on that section, without decreasing the length of his territory, in which case the cost would be small, amounting only to the cost of such material as needs to be supplied from time to time. It would be considerably more when the signals were installed on a territory which was unsignaled so far as the railroads were concerned, because it would take a considerable portion of the

maintainer's time to travel to and from the crossing signals. Such charges should be so adjusted as to include the additional cost of material provided for batteries, renewals and the like, and the additional cost of the maintainer's time, provided, the railroad was obliged to add to the maintenance force in order to take care of the signals. No additional supervisors, general managers, or presidents will be necessary on the railroad, and therefore no apportionment of their time should be charged as overhead against the maintenance of the crossing signals. In fact the railroads could well afford to throw in all the overhead, provided they were relieved of the actual additional expense in dollars and cents, to which they are now put in installing and maintaining such signals.

Conclusion—The universal adoption of light signals using the railroad system of indications, red for danger, yellow for proceed with caution, and green for proceed, is suggested, together with the universal location of these lights not more than 7 or 8 ft. above the roadway level so that the driver of an approaching car will be sure to see them. Their location transversely of the roadway will depend more or less on local conditions. Generally speaking, they should be located at the right of, or possibly in some cases, in the center of, the roadway.

Missouri River Bridge Rebuilt for Heavier Loading

Old Spans in Good Condition After Forty Years, But Too Light for Modern Loading—Old Masonry Piers Unaltered

RECONSTRUCTION of the Missouri River bridge at Blair, Neb., on the Chicago & Northwestern Ry., carried out in 1923, was made necessary by the fact that although the structure was in excellent condition it was not strong enough for the greatly increased loads of recent years. The new superstructure is carried on the old piers. As built to the plans of the late George S. Morison in 1883, the bridge consisted of three 330-ft. through-truss spans, with headroom of 50 ft. above high water; at each end was a 110-ft. deck truss and a 22½-ft. deck girder span, but in 1885 a 176-ft. truss replaced the original west approach spans owing to a movement of the adjacent embankment. In 1923, this was in turn replaced by two girder spans.

The renewal of this bridge was described at a recent meeting of the Western Society of Engineers by C. F. Dalstrom, bridge engineer of the Chicago & Northwestern Ry., and an abstract of his paper is given below. In the discussion, A. F. Robinson (Santa Fé Ry.) referred to the peculiarities of live-load assumptions in old bridge designs and pointed out also that the ¾- and ⅞-in. material used in the new bridge could not have been obtained twenty-five or thirty years ago. That the modern tendency towards simplification is indicated in the new bridge was remarked by A. Reichmann (American Bridge Co.); thus the number of panels has been reduced one-third, with considerable reduction in the number of pieces, resulting in better efficiency and in reduced cost of production and erection.

Substructure—Four masonry piers sunk to rock at 52 ft. below low water by means of pneumatic caissons carry the three main spans. These piers are of Minnesota limestone, but two of them have granite cutwaters on account of the heavy ice. Thorough inspection in 1923 showed slight spalling and pitting by the weather and some cracked stones, but the effects were hardly appreciable; the mortar in the joints was in excellent condition although no pointing had been done since the bridge was built. The inspection indicated that the piers were good for fifty years at least.

Superstructure—The old spans were built up of a combination of steel and wrought-iron members with cast-iron pedestals. In the through spans the top chords, end posts, nine central panels of bottom chords, the bolsters, rollers, bearing plates and all pins were of steel; the other parts were of wrought iron, except the pedestal castings and portal ornaments. The deck spans were of wrought iron except for the steel pins, rollers and bearing plates and the pedestal castings. The steel blooms were manufactured by the Cambria Iron Co., the shapes were rolled by Carnegie Brothers & Co., and the fabrication was done by the Keystone Bridge Co. The live-load provided for in the trusses was 3,000 lb. per foot of track, except that in the web members and the floor system it was taken as 5,000 lb. The rating of all the spans, based on Cooper's loading, was E-25.

The new superstructure, designed for Cooper's E-60 loading under the A.R.E.A. specifications of 1923, was designed, fabricated and built by the American Bridge Co. Falsework for the three river spans consisted of framed bents on piles. In checking the falsework plans the railroad changed the lighter longitudinal and transverse braces to 12 x 12 and 12 x 16 in. so as to secure good bridge timber in salvage; this heavy bracing rendered good service during a sudden rise of the river. In the entire program of erection there were only two periods of suspension of traffic, but at times it was necessary to hold trains until the locomotive cranes could let go of the work in hand and move off the bridge. The deck, track and railing were placed by railway forces. Five expansion joints in the rails conform in position to the expansion ends of the spans, while a rail expansion joint at each end isolates the bridge track from the approaches.

Good Condition of Old Spans—The entire superstructure was in excellent condition when taken down. No reinforcing and very little repair work had been done during the forty years of service. In 1900, the short sections of eyebars in the adjustable counters in the river spans were replaced with new pieces, on account of defects that had developed. In 1920, the connection angles in a number of stringers of the river spans were found to be cracked in the fillets and were replaced. In the same year, several floorbeams in the 110-ft. and 176-ft. approach spans were repaired where they had developed cracks in the webs near the bottom of the stringer connections, evidently due to the thrust from the ends of the bottom flanges of the stringers. In 1923, some cracked connection angles of stringers in the deck truss spans were to be replaced, but the spans were taken out before this was necessary. The cause of failure in the floor member details at such a late date was probably the heavy cars, which by 1920 were more severe on the floor members than the locomotives, as there had been no increase in the weight of locomotives over the bridge for about twenty years.

There was no evidence of deterioration of the structure when taken down. There were no shoulders on the pins and no elongated pin holes. A number of the pins stuck fast in the top chords and the posts; those in the chord were burned off while those in the posts were left, the eyebars being simply slipped over the ends of the pins. This bridge is a good demonstration of the endurance of such a structure under favorable conditions of service and maintenance. It represented the best class of material and workmanship of its day. Traffic was comparatively light, only a few trains a day each way. Situated at the summit of long approach grades, it was never subjected to high speed, as trains could scarcely attain the allowed speed limit of 10 m.p.h. Loading was always well within the capacity of the bridge until recent years, when trains of heavy cars probably produced stresses in light truss members above the limits allowed in good practice. After forty years of service, there were no indications from which to determine the limit of life of the structure under existing conditions. It looked good for forty or fifty years more of the same kind of service.

The Water Department as a Self-Controlled Utility

A Brief Against the Inclusion of the Baltimore Water-Works in the Proposed Department of Public Works and for Its Continuance Under a Water Board with Enlarged Powers

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This forceful statement of the case for vesting control of municipally-owned water-works in a board almost completely independent of other parts of the city government, although written primarily from a Baltimore viewpoint, is of such broad interest that it is given here nearly in full, the chief omissions relating to the extent of the Baltimore water-works and other local matters. Editorial comment on the brief will be found elsewhere in this issue. The brief was submitted by the Water Board to the Efficiency and Economy Committee of Baltimore, which is dealing with city department reorganization.—Editor.

THE SUCCESS of any business enterprise depends upon its conformity to the fundamental laws of political economy, which no authority of the business world will gainsay. The city government assumes the rôle, in a broad sense, of the entrepreneur when it undertakes to market a commodity or service. In other words, it becomes a public corporation, which is defined as an organization performing public service in supplying the wants of society, the community being the consumer, maintained by public funds and operated without profit. The corporation whose form of business is of a public or quasi-public nature is known as a public utility. That department of the city government becomes a business unit which produces economic goods, that is, which furnishes a material good and personal service for consumption, and further it becomes an entity when specialization of labor and function becomes necessary for the production of a single economic good or utility. Thus, for better efficiency there are created subsidiaries to a central unit, each of which however reserves its individual identity, independent management and control, and, in fact, complete isolation except as to its subsidiary relation to the central unit through associated specialties.

Private corporations form subsidiaries because they recognize the gain in efficiency that is had from self-contained organization and organize such subsidiaries with complete functions.

Water Department a Business Entity—The Water Department fulfills the requirements of this business entity—its labor and function are specialized, its product is a single economic utility which is the result of the manufacture of a material good from the raw product or free good, to which is added personal service, before it is finally consumed after having been delivered by the department to the consumer. It is then a public utility entirely individual and should retain this individuality in the city government in conformity to both legal and economic law. The United States Supreme Court, and other courts, have held that when a municipality engages in the water business it conducts a "commercial enterprise" and is subject to the same rules at law as a private company engaged in the same business.

What makes for this entity of the Water Department as an individual public utility? It is the following: (1) Its function, (2) its contact with the public, the taxpayer-consumers, (3) its size, (4) the requirements of its service, (5) the unity of function which is necessary to guarantee the fulfillment of its service requirements.

Functions of the Water Department—As to its function as a utility conducting a commercial enterprise, the Water Department is engaged solely in the manufacture, sale and delivery of one finished commodity—pure water. Its revenue is derived entirely from the sale of this commodity and is not derived, as is the case of the other departments which are not public utilities, from the general tax levy.

The Water Department is an entity as regards its contact with the consuming public in that it has the power to fix rates and charges and to make regulations governing service, as well as those regulations necessary to insure a plentiful supply of pure water. In the sale and delivery of its commodity, the employees of the Water Department come in direct contact with 165,000 purchasers, and in order to maintain efficient service, it is essential that these consumers be in a position to make quick and satisfactory contact with the department which can only be had through its specialized employees.

Need of Personnel Unity—As to the third element of the Water Department as an entity, its organization is large both in personnel and valuation, and in all respects is similar to the Consolidated Gas, Electric Light & Power Co., a utility corporation, more nearly comparable to the Water Department in the nature of its service than any other local utility. The Water Department payroll includes, at the maximum, approximately 1,000 employees, and a recent valuation of the plant under the control of the Water Board places it at approximately $40,000,000.

The department is required under the Baltimore County Metropolitan Act to supply water to consumers outside the corporate limits and is subject to the jurisdiction of the Public Service Commission of Maryland, thus falling into the category of a private corporation. In order to maintain friendly relations between the city administration and the taxpayer-consumer, it is essential that the department be in a position to discipline its employees, especially those who are in direct contact with the public due to the nature of their duties in handling house service connections and repairs. This discipline is weakened where there exists no "esprit de corps," a quality lacking in most existing boards of public works.

The inherent unity of the department is self-evident when one considers that its employees are highly specialized professional workers, highly specialized artisans and skilled and unskilled laborers, whose duties are confined to the requirements of constructing, operating and maintaining a satisfactory water supply. There is no overlapping of function between the Water Department and any other of the city departments. This has been evidenced in the past by the poor showing of employees who have been transferred from other departments, there being an appreciable time required to instruct these employees in the requirements of their new duties. The service which the Water Department as a public utility is obligated to render can only be guaranteed through complete control of all of the factors of this service, intimate control of its machinery of production, as well as its accounting and cost-keeping personnel. In order to have efficient operation, it is necessary that we have through our own accounting personnel a close check, available at all stages of any project, upon the cost of individual operation and production units as well as an accurate check on the receipts for the service rendered—such accounting and cost data as we now have always at hand, prepared by accountants with specialized knowledge and experience in water-works.

Value of Being Self-Contained—It has been shown that legal and economic law requires that a public utility such as the Water Department be self-contained. To destroy this entity of the Water Department would therefore offend against laws of business economics, and a prominent and familiar example of this well-established principle is ably illustrated in the refusal of the Consolidated Gas, Electric Light & Power Co.'s officials to merge that utility with the United Railways & Electric Co. If the merger of two public service utilities is bad economically, it would appear even worse to merge a public service, or quasi-public service, with a distinctly public corporation. Centralization reaches the marginal limit of utility through the law of diminishing returns, and this applies very early in the case of city governments attempting to control public finances and public service functions, and has led to the creation of subsidiary boards with broad powers, especially in the

maintainer's time to travel to and from the crossing signals. Such charges should be so adjusted as to include the additional cost of material provided for batteries, renewals and the like, and the additional cost of the maintainer's time, provided, the railroad was obliged to add to the maintenance force in order to take care of the signals. No additional supervisors, general managers, or presidents will be necessary on the railroad, and therefore no apportionment of their time should be charged as overhead against the maintenance of the crossing signals. In fact the railroads could well afford to throw in all the overhead, provided they were relieved of the actual additional expense in dollars and cents, to which they are now put in installing and maintaining such signals.

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What makes for this entity of the Water Department as an individual public utility? It is the following: (1) Its function, (2) its contact with the public, the taxpayer-consumers, (3) its size, (4) the requirements of its service, (5) the unity of function which is necessary to guarantee the fulfillment of its service requirements.

Functions of the Water Department—As to its function as a utility conducting a commercial enterprise, the Water Department is engaged solely in the manufacture, sale and delivery of one finished commodity—pure water. Its revenue is derived entirely from the sale of this commodity and is not derived, as is the case of the other departments which are not public utilities, from the general tax levy.

The Water Department is an entity as regards its contact with the consuming public in that it has the power to fix rates and charges and to make regulations governing service, as well as those regulations necessary to insure a plentiful supply of pure water. In the sale and delivery of its commodity, the employees of the Water Department come in direct contact with 165,000 purchasers, and in order to maintain efficient service, it is essential that these consumers be in a position to make quick and satisfactory contact with the department which can only be had through its specialized employees.

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Value of Being Self-Contained—It has been shown that legal and economic law requires that a public utility such as the Water Department be self-contained. To destroy this entity of the Water Department would therefore offend against laws of business economics, and a prominent and familiar example of this well-established principle is ably illustrated in the refusal of the Consolidated Gas, Electric Light & Power Co.'s officials to merge that utility with the United Railways & Electric Co. If the merger of two public service utilities is bad economically, it would appear even worse to merge a public service, or quasi-public service, with a distinctly public corporation. Centralization reaches the marginal limit of utility through the law of diminishing returns, and this applies very early in the case of city governments attempting to control public finances and public service functions, and has led to the creation of subsidiary boards with broad powers, especially in the

control of water supplies. We have seen how any specialization of service leads to the formation of subsidiary corporations.

Learning then from experience of the business world that a variety of separate specialized services cannot be supervised in detail by one central control, what would be the result of merging the business of supplying water with the other departmental functions of the city government? If a person would succeed in any profession or business, he must feel sympathetic toward the object of his effort. Any man at the head of many departments must necessarily feel more sympathetic toward one department or specialized group than toward others. The vitally important functions of the Water Department might readily be subordinated at the hands of a director of public works who does not realize its needs at first hand.

According to general knowledge of the organization of municipalities along the lines of both the centralized mayor-council plan and the city manager plan, the Department of Water Supply is always found separate and distinct from the Department of Public Works even when a plan is adopted which is very similar to that proposed for Baltimore. If this fact is disregarded it may be predicted with reasonable certainty that at some period or other attempts will be made to manipulate water rates and regulations directly with the tax rate. Any efforts which have been made in the past, either to increase water rates above the cost of production or to reduce them materially below the cost of production, have invariably been followed by a decrease in efficient operation. When the department is operated on a balance sheet, there is no incentive to purchase equipment or to employ personnel which will not directly reflect in reduced cost of operation.

In the event of the subordination of the Water Department to a Board or Department of Public Works, it may be further predicted that the present promptness of service rendered by the department to complaining taxpayer-consumers and county consumers would be greatly hampered by the lack of control over its necessary transportation facilities. Machinery and vehicle equipment are now kept at a high state of efficiency through prompt repairs and through the absence of routine which would operate against prompt attention. By virtue of the present material yards and shops the department is enabled further to repair quickly defective mains and pumps, and even employ its same force to manufacture, at a fraction of the market price, certain of its specialities, such as manhole vaults, etc.

Water Department a State Agency—Rather than curtail the present powers of the department, it seems essential to efficiency and economy that these powers be broadened. The various organizations of the city enjoy corporate functions only in so far as these functions are granted by express state legislation. The Water Department is now a state agency not expressly incorporate, being a quasi-corporation, endowed by legislative enactment with certain powers which can best or only be exercised corporately. "To such bodies is given the name of quasi-corporations and as to them the rule is that for the purposes defined in the creating statute, their status is that of true public corporations; they are such by implication." (France: Principles of Corporation Law.)

It seems advisable, then, to request from the state legislature such powers as will enable the Water Department to operate more nearly as a true public corporation. The personnel of the Water Board, composed of seven members —including the mayor (ex-officio), the comptroller (ex-officio) and the water engineer—should be direct representatives of the taxpayers of the city, the common and preferred stockholders in the municipal corporation, one of the five non-ex-officio members to be appointed each year for a term of five years. The board should have control over bond issues designed expressly for the improvement of the water supply, fix and control rates, collect revenue and perform such other duties and make such regulations as are directly essential to the operation of the department. The rates would be fixed at such a level that they would not alone provide for the operation and maintenance of the system but also supply the interest and sinking fund payments necessary on bond issues, which method of financing is provided for in the creation of the Baltimore County Metropolitan District. These rates would be a direct index to the efficient operation of the department and would give the voter of the city an opportunity to criticise its operation and to express his approval or disapproval of its management at the polls.

If the Water Department were merged with the Board or Department of Public Works, dissatisfaction with its operation would almost certainly lead directly to the creation of a city commission on public utilities which would have direct jurisdiction over all public utilities operating in the city of Baltimore, and would likely lead further to public ownership of all privately owned, as well as public, utilities, crystalizing the public sentiment which now exists for such an ownership. The recently drafted charter for Kansas City, Mo., provides for the public ownershhip and operation of all public utilities.

Successful Operation Elsewhere—In support of the above recommendations for increased powers we cite recent reports of efficiently operated water departments: 1. Hartford, Conn. C. M. Saville, authority on financial management of water-works, in the *Journal* of A.W.W.A., January, 1924, p. 64, says: "We are practically a private corporation. We have a charter of our own, although it is a municipal corporation. The only connection we have with the city is that each year the mayor appoints two members to the board, who are confirmed by the council; after that the board functions independently, using all its funds as it deems proper, and can sue and be sued. If we change the rates they have to be approved by the council, as does also the bond issue, which becomes then an obligation on the city."

2. Detroit, Mich., supplying 1,371,500 people. A Board of Water Commissioners, appointed by the mayor, awards contracts on advertised proposals; conducts all employment activities under Civil Service Commission Regulations; plans for additional supply; has power to establish rates and to supply water outside city limits—the department is self-sustaining and is obligated to pay principal and interest on bond issues. which must be approved by the mayor and city council; operates storage yards, shops and construction machinery; has direct control over its own collection, cost and general accounting, auditing and complaint divisions.

3. Los Angeles (1925 charter). A water and power board, composed of five members appointed by the mayor and approved by the council, has full jurisdiction [of water-works and electric light and power.—EDITOR], even to the extent of making an independent budget, and is answerable only to the mayor and city council. A board of public works controls construction and maintenance of streets and sewers, street cleaning, garbage and sewage disposal and public buildings.

Nothing more need be said. Bureaus of water supply have been included in Departments of Public Works and on the other hand they have been isolated and given the broad powers of complete control. In the latter cases the operation has been successful and examples of such successful operations have been cited in the foregoing paragraphs.

A municipality engaged in the water business is by action of the courts considered as a private company. The Water Department is this business unit. By all the rules of business law it should retain this entity, and should even be given, according to the practice of private enterprises, every power making for an independent control, without which is lost that stability of management dependent upon a proper co-ordination of responsibility. The business of the Water Department cannot be successfully conducted except in accordance with economic law and sound business practice.

Improving Government Maps in Canada

In order to provide more accurate maps of many parts of Canada where there are no accurate maps now, the Topographical Survey of Canada, in co-operation with the Royal Canadian Air Force, is preparing new maps of certain areas by the use of airplane photographs aided by a small amount of ground survey. In order to increase the area covered the work is not carried to a great refinement but is planned to secure reasonably accurate maps of a great deal of territory, that otherwise would not be mapped for years to come.

Belt Conveyor Handles Concrete for Large Aqueduct

Covered Drain Replaces Scajaquada Creek in Buffalo—Gasoline Car Handles Steel Forms—Conveyor Travels on Top

CONSTRUCTION of the second section of the large covered drain by which Scajaquada Creek in Buffalo, N. Y., is being put underground, has developed novelties in form handling and concrete placing which are giving a notable progress record. Under normal conditions a section 75 ft. long of 33½x14-ft. reinforced-concrete conduit (about 5½ cu.yd. per foot) is being completed in a day and on occasion this rate has been doubled. In 80 working days 7,200 ft., 35,000 cu.yd., were completed. Backed by an excellent plant, good direction and a trained crew, two factors are primarily responsible for the record. They are: Expeditious form handling and belt distribution of concrete.

The section of drain being built by the methods to be described is 7,200 ft. long. It continues a section 6,022 ft. long previously constructed of substantially the same design. The cross-section is shown by Fig. 1 which is a strengthened section under a building; the dotted line indicates the normal arch ring. Except at a few points the drain follows the alignment of the creek and at one end of the section there results a succession of curves. This crooked part is being built first so that the records so far represent the most troublesome portion of the contractor's task. The creek channel has a capacity of some 1,500 sec.-ft. The dry-weather flow is 5 to 20 sec.-ft., but between Nov. 1 and May 1 there are normally several floods of 500 to 1,000 sec.-ft. In flood the stream overflows a section of the city and besides it becomes a sort of catch-all and calls for many street bridges. When the drain is finished it will be backfilled to city grade.

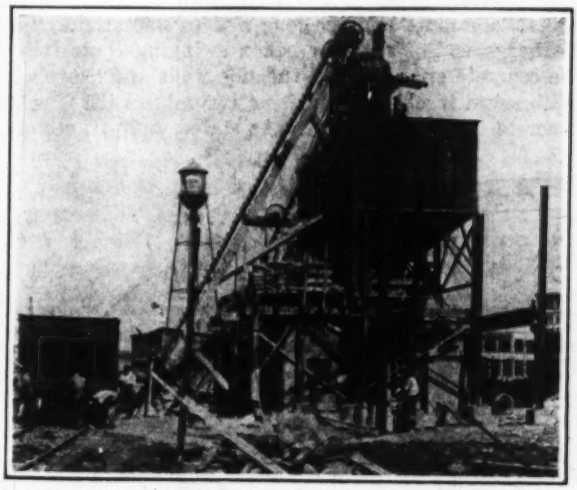


FIG. 2—UNLOADING MATERIALS AT MIXING PLANT

Excavation—The creek channel is in earth overlying rock. It had to be widened and deepened for the drain, the excavation volumes being 122,000 cu.yd. of earth and 90,000 cu.yd. of rock. A steam shovel first made a stripping cut of the earth overburden, loading it into cars which ran up the bank, and built spoil bank alongside ready for backfilling the drain. It is planned to equip this shovel with a drag bucket for backfilling.

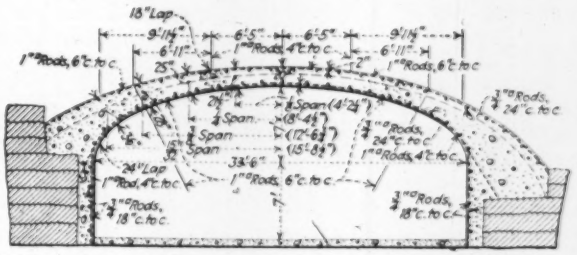


FIG. 1—SCAJAQUADA CREEK CONDUIT IN BUFFALO, N. Y.

There is from 1-ft. to 14-ft. cut in the rock which is a hard limestone in 1- to 2-ft. strata. Except that the stone has been wearing on drills and dipper teeth it has offered no exceptional obstacles. A cut to subgrade and about 24 ft. wide is first made along the center line in the usual manner of taking out rock bench. Two side cuts finish the channel. In taking out the side cuts the shoulders for the arch are cut in the

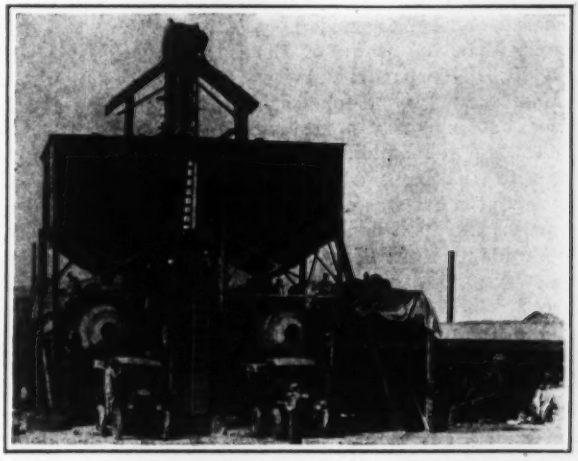


FIG. 3—MOTOR TRUCKS TAKING LOAD AT MIXING PLANT

same operation. The side holes are put down 9 in. apart—virtually line drilling—and alternate holes are fired. Generally the rock breaks cleanly. The steam shovel loads the blasted rock into cars to a rock storage pile whence it is being hauled to the contractor's crushing plant and there worked up for the crushed stone market by an 18x30-in. jaw and a No. 5 gyratory crusher. About 200,000 tons had been marketed as of Oct. 1, 1924. None of this stone is used in the drain concrete. Five 7-ton gas locomotives are doing the earth and rock hauling.

Concrete Construction—The concrete structure of the drain is shown clearly by Fig. 1. Its dimensions are to be noted; this is an exceptionally large continuous conduit. The floor or invert is separate and the sidewalls and arch are one piece. In the 7,200 ft. about 37,862 cu.yd. of concrete and 3,464,674 lb. of reinforcing steel are estimated. This gives 5½ cu.yd. of concrete and 481 lb. of steel per foot which are figures to be remembered in considering the 75 ft. progress in a day. The specifications called for a 1:6 concrete and 14 turns of a 22 r.p.m. mixer. A slump of 8 in. in an 8x16-in. cylinder was required. No concrete could be laid under 32 deg. F. and between 32 and 40 deg. F. the mixing water must be heated to 120 deg. The reinforcing bars are deformed.

A particularly well fitted mixing plant was put up as

shown by Figs. 2 and 3. Stone and sand brought in hopper-bottom cars are dumped into track pits and taken to the 90-cu.yd. steel bins by a bucket elevator. Cement comes in bags which are loaded directly from the car onto a belt to the mixer floor or, the surplus, to the cement house. The two 1-cu.yd. mixers dump out-board into 2-cu.yd. trucks, two 25-cu.ft. batches to a truck-load. Seven trucks take the concrete to the bank hoppers, which, as is described later, feed to the belt conveyors. The maximum truck haul has been 3,000 ft. and was made in 12 min.

Belt Conveyors—As shown by Fig. 4 the banks of the creek generally were considerably higher than the crown of the conduit. This particular view shows open ground on each side but frequently bridge abutments and buildings come close to the bank edges and access to the cut was only at intersecting streets. Also at places the spoil banks interfered with any generally applicable plan of rail or truck haulage along the banks close enough to the cut to handle the loads of concrete directly into place. Haulage along the cut bottom offered obstacles of its own. Some method of distribution predicated on access to the cut only at street intersections appeared necessary. Truck haulage to the points of access was practicable. The nub of the problem was to get the concrete down the bank and along the conduit anywhere in the approximately 300-ft. distance between streets.

FIG. 4—BELT CONVEYORS HANDLE CONCRETE INTO FORMS

Consideration of the problem by Frank L. Cohen, the contractor, with the engineers of the Conveying Weigher Co., developed the belt conveyor system shown by Fig. 4. From a bank hopper into which the trucks dump a 40-ft. cross-conveyor extends to the crown of the conduit. Here a 310-ft. conveyor mounted on carriages takes the concrete along the conduit. The long conveyor is pulled along the structure—finished concrete and forms—as the concrete placing advances. Except that the long conveyor is mounted on carriages, both conveyors are of regulation design for conveying concrete. Both conveyors are electrically driven—a 3-hp. motor for the cross-conveyor and a 10-hp. for the long belt.

In operation the cross belt has a traveling speed of 320 ft. a minute and the long belt of 350 ft. At the discharge end of the long belt a swinging chute turns the concrete either way to the side walls and haunches. With seven trucks hauling from two mixers the flow of concrete is fairly constant. As stated, a 75-ft. section

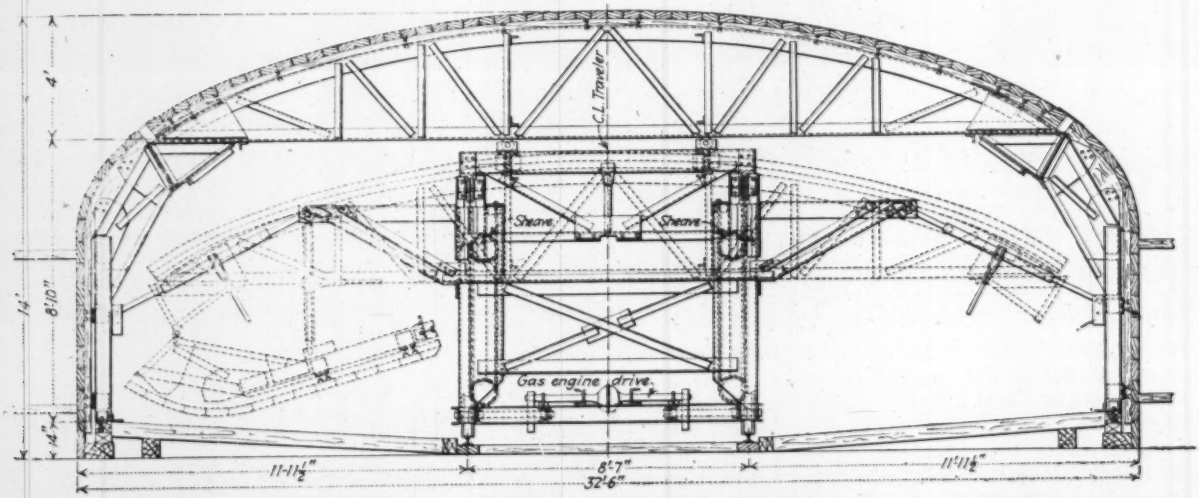


FIG. 5—DETAILS OF FORMS AND TRAVELER

is the regulation 8-hour day's stint but often this progress has been exceeded and on occasions doubled. A 75-ft. section calls for an output of something less than 375 cu.yd. The delivered concrete has at all times met the city inspector's requirements governing segregation.

Only side walls and arch are placed by belt conveyor. The invert, Fig. 1, is built ahead using trucks from the mixer and chuting the concrete down the bank to hand carts operated along the bottom. Approximately the schedule is one day concreting invert and five days concreting walls and arches, but this arrangement has been varied when delay on arch has left a crew free to push the invert ahead of schedule. On arch and side wall the normal schedule is: 3 days

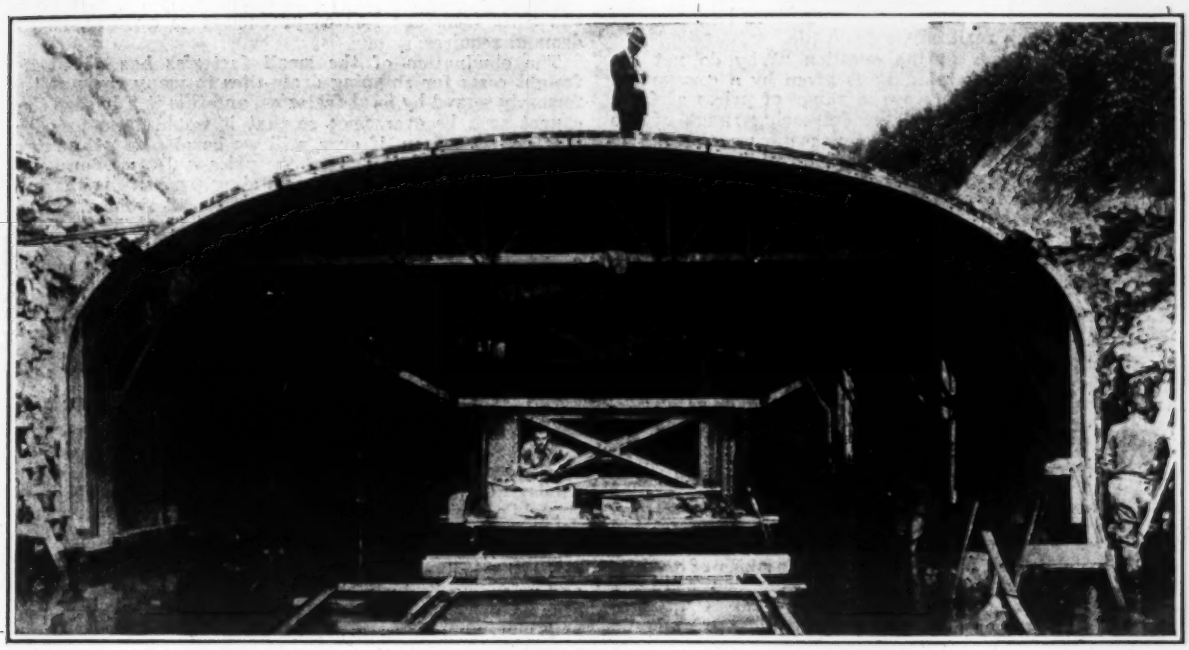


FIG. 6—FORM READY FOR CONCRETING

forms under arch, 1 day erecting forms, 1 day placing reinforcement and 1 day pouring concrete.

Form Handling—A vital factor in the fast schedule is form handling. The method was worked out in conjunction by the city engineers, the contractor and the Blaw-Knox Co. engineers. It involved agreement on a remarkably quick striking period for arch forms. Figures 5 and 6 show clearly the form construction. Three 25-ft. sections of the form were erected in a day. In all the contractor had 18 sections of 450 lin.ft. of forms. The figures are noteworthy.

As shown in Figs. 5 and 6 the form is of the telescopic type of sufficient strength to carry the load without being supported on the traveler, the sole purpose of which is to move the forms from the rear up to the front. For raising and lowering the forms the traveler has a telescopic platform raised and lowered between four corner guide posts by means of chain blocks on the posts. Outriggers on each side of the platform carry heavy ratchets which attach to the side posts of the forms and which are used to pull in and push out the sides of the forms when collapsing and erecting them. These details are best seen from Fig. 5. Turning back to the traveler, it will be noted that to set 75 ft. of form a day the traveler had to make three trips from front to rear and return or about 3,000 ft. of travel. A motor traveler was necessary. A Ford car motor and driving axle met the requirements by the arrangement shown by Fig. 5. Another structural detail is that a sliding arrangement was provided at the ends of the top truss making it possible to widen or narrow the form as the cross-section changes. Also the forms were made in such a manner that they could be sprung out on curves and follow the contour of the exact curve as closely as desired. It was found possible by this arrangement to work the forms up in 25-ft. units, which could be bolted together on straight work along the edges and on curved work along the side wall on the inside curve, and, with a filler piece or overlapping plate covering the opening in the arch and the opening in the side wall on the outside of the curve.

The notable feature is, however, not so particularly the structure and mechanism of the forms as it is the small total length of forms, 450 ft., and the quick action in erection. Both were made possible by the decision to allow form removal in three days. This came from consultation. Originally the idea of the city engineers was that the wall should be cast up to the spring line before the arch was put on. Next it was stated that the forms over the arch should be left in place three weeks. This would necessitate having about 400 ft. of wall form and about 1,500 ft. of arch form, which again would increase the stretch of work on which the contractor had to work to more than 2,000 ft. and make a railroad necessary and not a track and traveler. Consideration of the facts led to the change in plans, which have proved successful.

The conduit work is being done under the direction of William F. Swartz, commissioner of public works, E. E. P. Babcock, city engineer, and Carl Howell, assistant city engineer. The contractor is Frank L. Cohen with Bill Reiman as superintendent.

Some Notes from the Drainage Congress Convention

Improving Drainage Districts—Effect of Levees on Flood Flow—Tile Drainage and Range of Prices for Tile—Headwater Reservoirs and Water Conservation

Drain Tile Costs and Farm Drainage

By J. W. Dappert
Civil Engineer, Taylorville, Ill.

THAT there has been little tile drainage done for the past four years is due in part to the decreased production of tile during the World War and the continued decrease when the demand for sewer pipe and other building materials consumed the entire product of the larger factories for several years at prices much more remunerative than had ever been realized for drain tile.

A complete answer to the question "Why do not the farmers drain their wet lands" is given by a comparison of curves showing the increase in range of prices of farm products and drain tile and the decreasing range of the purchasing power of farm products during the period 1913-1924. Tables of the prices of drain tile in my locality show a 300 per cent increase between 1893 and 1922; and similar tables of prices paid for laying tile show an increase of 250 and 200 per cent for the smaller and larger sizes, respectively. Furthermore, the prices of both material and labor in the tile drainage industry are higher than the average prices of non-agricultural products in general. But as the curve of farm prices began to ascend and that of drain tile to descend, notably during the latter part of 1923 and through 1924, there came a marked increase in the sale and use of drain tile and in the quantity of all kinds of drainage work being done. If the drain-tile manufacturers will fix and hold prices at a reasonable rate without taking too great a profit, the tile industry will speedily return to its pre-war condition.

Now, as to the prospect for the drain-tile industry, I will say that not 5 per cent of the tile drainage needed has been done in the central Mississippi Valley states. As land values increase and farm products come more into demand, there are numerous areas of "gullied" land which will be reclaimed by use of tiles or drain-pipes of various kinds, with surface-water inlets for the admission of excess water, putting the flood waters underground in pipes so that they will not cause destructive erosion of the land.

The construction and installation of tile drains is a large part of the cost of farm drainage and has not been reduced to a much greater extent than the cost of drain tile. The principal reason for this is that all labor cost is high, and during the years of small tile construction the labor formerly employed in this line of work found a new form of employment. As a result, it has become difficult to obtain good workmen who are efficient especially in grading the drains and laying the tiles. More and more machinery is being used to do this sort of work, and less and less are men inclined to do the actual hard work of digging the trenches for the construction of tile drains. There are a number of types of machines now available for this work.

COST OF DRAIN TILE AND TILE LAYING

	Common Tile		Vitrified Tile		Tile Laying	
	6-in.	8-in.	16-in.	24-in.	8-in.	24-in.
1893	$24	$40	$200	$500	$0.48	
1906	26	44	250	580	0.58	$1.50
1914	28	49	280	610	0.74	2.40
1917	45	80	280	650	0.68	2.00
1920	62	105	550+	1,197+	1.25+	3.25
1921	77+	125+	489	1,100	1.11	3.08
1923	50	90	450	1,075	1.00	3.96+
1924	50	90	435	957	0.92	3.96+

Note: The accompanying table is condensed from the figures given in the paper. The prices for tile are per 1,000 ft. The prices for laying are per rod, with an average depth of 4 ft. in ordinary soil, including trenching, tile laying and back filling. Maximum prices are marked with a cross.

The greatest handicap which has come to the farmer and landowner during the distressing period of deflation has been the actual failure and discontinuance of hundreds of small tile factories scattered over the central states. In former days there was a small tile factory in almost every small village, especially in central Illinois; some of these factories operated upon an extensive scale and shipped drain tile far and near. The depression caught most of these smaller factories and put them out of business; their machinery is now a junk-pile and their capital gone; it will require a large amount of capital to rehabilitate them and most of them will never operate again. This again has had a tendency to concentrate the business in a fewer number of plants, most of which are also manufacturing sewer pipe or other lines of building material, and which can shift from one line of production to another, as the demand requires.

The elimination of the small factories has added the freight costs for shipping drain-tiles to many communities formerly served by local factories, and this is a burden that cannot soon be overcome; so that it would seem probable that not very soon, if ever, will we be able to get prewar prices upon drain tile. That the price will come down to a par with the prices of other building products is the best we can expect for a number of years. Anyone who contemplates the installation of a system of drainage might as well go ahead with his work now. The prices, no doubt, will gradually decline with prices of other products in general, but it will be a slow process.

* * *

Storage and Conservation of Water

By Clarke E. Jacoby
Consulting Engineer, Kansas City, Mo.

WATER-POWER development in New York has been so retarded by unfavorable laws that the artificial pondage of power reservoirs does not exceed 450,000 acre-ft., while a single project in Missouri will have a pondage of at least 700,000 acre-ft. This condition should be a lesson for the Middle West, where administrative and legislative bodies should acquire right-of-way for reservoirs and retarding basins while the land may be secured at reasonable prices. Reservoirs for combined flood prevention and power purposes are impracticable, since the former purpose requires the reservoir to be normally empty; therefore, separate additional space must be provided to store water for power development. There is another feature, however, in the possibility of the development of water power along the main stream below the retarding reservoir by the regulation and distribution of flow in the river.

There has been discussion as to whether the additional storage space necessary for the control of extreme floods should be controlled by spillways or conduits. As a general rule, the ideal control would be secured with openings or conduits which could be made to provide any rate of flow desired at any particular time. The regulation of flow in river channels by means of reservoirs would not only assist navigation, but would tend to stop erosion caused by flood flow and to reduce the cost of stabilizing river channels. It would also bring about better sanitary conditions in the valley by assisting to reclaim the overflowed lands and swamps which are the breeding places of the malaria-spreading mosquito.

As engineers, we should devise means of providing funds for exhaustive studies of the possibilities of reclamation and flood control in our valleys; we should give more consideration to the storage and conservation of water by means of reservoirs at the headwaters of streams, and we should consider the beneficial results of such a method of regulating the flow of water for hydro-electric power and for navigation. In view of the difficulties in carrying out such a scheme, the Drainage Congress can engage in no better work than fostering the enactment of state and federal laws providing for such conservancy districts as will enable engineers to study water conservation in its broadest sense.

Utilization of flood control and power pondage for fish-

eries and homes for migratory birds is another aspect, but there should be no controversy on this subject between the Drainage Congress and the Izaak Walton League, conflicting plans being settled by arbitration. There are plenty of open spaces which can be converted into lakes and reservoirs that will be better adapted for the use of game than some of the present swamps. We should plan for the conservation of our water resources as well as for the reclamation of our lands.

* * *

Engineering Improvements on Old Drainage Districts

BY C. H. YOUNG
Central States Engineering Co., Muscatine, Iowa

ON A stream where a number of levee districts have been constructed one after another, with several years intervening, we find the flood heights with same volume of discharge modified and raised to such an extent that the levees are wholly inadequate when all of the districts are constructed. This is occasioned by narrowing the size of the channel and creating a much higher stage at narrow points in the stream. Such a condition, together with sudden inflows from tributaries adjacent to the levee districts, baffles hydraulic formulas and hydraulic analysis in the design of the original improvement, so that ofttimes it is necessary to raise levees several times until flood records are acquired after all of the separate districts have been constructed.

If the stream could have been improved as a whole and all districts designed simultaneously, perhaps better improvements would have resulted in the first instance. However, I am familiar with a case where the engineer did work out a correct hydraulic analysis but his plans were not followed, because the cost of the proposed improvement seemed a greater burden than the land could bear at the time. As a result, it was necessary to raise the levees after they had been overtopped three times in twenty years, but the land was then better able to stand the cost of the improvements.

There was a great deal of fighting in regard to the responsibility for such conditions, one district claiming that it was the fault of another, until the Iowa case of Maben vs. Olson (187th Iowa, p. 1060), when it was held that: "There is no right of action for damages on the part of the owner of lower lands because of the damage caused by the accelerated and increased flowage of water in a natural water course; and the remedy of the owners of such lands is to establish another district and carry the water on past their lands."

Experience has revealed that levees in many old districts were not only inadequate in height but were not broad enough in base to permit the line of saturation to pierce the foundation; also that levees had been constructed over stumps which decayed and formed cavities. In other cases, levees were built without exploration trenches or muck ditches which would intercept holes in the soil upon which the levee was placed; thus it was necessary to overturn many old levees and construct new levees in their place because of the excess seepage through the improperly constructed old levees.

Modern design provides for the facing of old levees and filling of borrow pits with sand pumped from the stream, which seals up holes caused by rodents and prevents further destruction from this source. By using 1:3 slopes in protected places and 1 on 4 and 1 on 5 slopes in exposed places, an effective method of insuring against erosion has been found. And in many places subaqueous revetment is used to prevent undercutting of the toe of the levee. For districts where the levees are sufficient but the capacity of the pumps is inadequate to handle maximum conditions it may be found expedient either to add another pumping unit or to build an additional plant.

In other cases the interior collection system of ditches is inadequate. Perhaps the main arteries will provide adequate outlet but the tributaries are either not numerous or they are of insufficient depth and overgrown with weeds and brush. It becomes necessary then to, determine whether the system requires deepening, widening, additional tributaries, or all of these. In one district which was properly redesigned and provided for 72-ft. bottom outlet, when the board observed the cost of improvement the outlet was modified to 32 ft. and the main lines were modified from 20 to 10 ft. Recent heavy storms have proved that the first design would have been more economic, because of the damage done to the small improvement and the inadequate drainage which it furnishes.

It is only fair that the party who pays the bills should know the cost and class of improvement that he is buying and I make it a practice to inform my clients that if they build a certain type of improvement it will only provide for a capacity equal to a 1-in., a 2-in. or a 4-in. rainfall, as the case may be, and that it is up to them to select the type of benefits that they desire to purchase. If the landowner is made familiar with these facts he cannot expect an improvement designed for 25 per cent efficiency to perform 100 per cent efficiency.

Old ditches often fill up and become filled with weeds and brush, while a very small amount of work in time would have prevented a later expensive improvement. The machinery used in the reconstruction of a ditch system depends upon the character of the problem. The straddle machines are good for small cleaning or deepening work, while the dragline machine can be used either on water or land, being mounted on a barge in the former case.

Another important matter is the problem of more minute drainage with the use of drain tile. Although volumes have been written upon the subject and a great many of our landowners are familiar with the merits of a well-constructed system of tile drains, there is still a great lack of practical application of well known and established facts. I was employed to tile 160 acres of land which had three outlets. After purchasing 4-in. tile the owner asked me to examine them as to quality and to set the grade stakes. I told him that the tile was good, but asked him where the mains were. He said that it was customary in that section to use 4-in. tile for mains as well as laterals, but I did not see how he could expect to carry thirty-five 4-in. laterals on one 4-in. main, except he had plenty of fall, which was not the case. An examination of the farm revealed that waters of his neighbor discharged on his farm, which required added capacity. He was finally convinced that he should put in two 10-in. outlet drains and one 8-in. outlet. He was advised also that it was not fair to spread the cost of the system over the first year, because its service extends over a number of years. The system cost him some $10 an acre for the farm as a whole and he decided to spread the cost over ten years, resulting in an apportionment of $1 per acre per year. However, the farm value advanced $20 per acre the first year after the improvement and the increase in crops in the first two years practically paid for the improvement.

Revision of Reclamation Act Proposed by Dr. Mead

Stating that complete revision of the reclamation act is a prerequisite to the success of future reclamation, Commissioner Elwood Mead in the January *New Reclamation Era* outlines the fundamental changes needed as follows: (a) The Bureau of Reclamation should have its duties and responsibilities more clearly defined; (b) the time has come for requiring interest payments on the construction costs of all new projects; (c) because of increased costs, methods of colonization and farm development are matters of first importance; (d) to promote home ownership for the settler of small means, a fund must be provided from which advances can be made to help selected settlers; and (e) the law should require state co-operation on all new projects.

In support of requiring interest payment, Dr. Mead says it would put reclamation on a business basis, would end the favoritism of developing private land with interest-free money, would tend to stop the inflation of prices of unimproved land, and it would help rather than burden the legitimate settler, by protecting him against paying twice for his water right—once to the government and a second time in high land prices.

Momoyama Hydro-Electric Plant Added to Japanese System

Moderate-Head Plant High Up In Japan Alps—Low Masonry Weir Diverts River Into Long Concrete-Lined Tunnel

By S. Kinugawa
Water Power Engineer, Daido Electric Power Co., Tokyo, Japan

MANY RIVERS rising in the central portion of the mainland of Japan, in the plateau of the so-called Japan Alps, have such steep gradients and are so advantageously situated with reference to the demand for electrical energy that they have received primary consideration in the development of water power. The Kiso is the foremost of these rivers in regard to the amount of power available and in economical development. Rights to most of the power sites are held by the Daido company. Three plants with a combined capacity of 34,900 kw. are already in operation, two plants of 63,800 kw. capacity have just been completed, one 42,900-kw. plant is under construction and six plants of a combined capacity of 150,000 kw. are about to be developed.

The Momoyama plant is the uppermost of these plants, situated at a point 150 miles from both the imperial city of Tokyo and the largest industrial center in Japan, the city of Osaka. Power from this plant is supplied to either of the two cities according to the demand but as the cycles in use in the cities are not

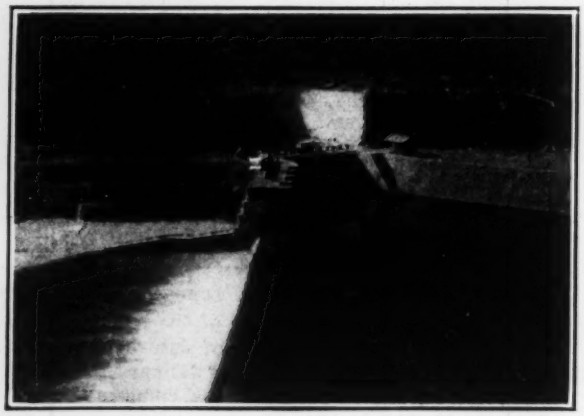


FIG. 1—WEIR ACROSS KISO RIVER, INTAKE AND CONTROL GATES

the same—Tokyo and its district 50 cycles, Osaka and its district 60 cycles—the Momoyama plant supplies power of different cycles. It is the first plant in Japan to do this.

Diversion Weir—Water for power development is diverted from the Kiso River by a cyclopean masonry weir 282 ft. long and 19 ft. high across the main channel. Its section is a trapezium having a top 12 ft. wide at a slope of 1:2 to the rear. The rear face has a slope of 1:0.1 and the front of 1:0.3. The weir is protected by a 45-ft. concrete apron faced with stone, beyond which is a mat of cribwork 3 ft. higher than the apron and extending downstream for 42 ft. A fish ladder and three sluice gates are built into the right-hand abutment of the weir.

The intake is at the right-hand end of the weir at an angle of about 60 deg. to the direction of the stream. It is equipped with trash racks and with 4 steel regulating gates 9x10 ft.

Headrace—The headrace is made up of two sections of tunnel of horseshoe section 15 ft. high and 15 ft. wide with a water depth of 12 ft. and a slope of

FIG. 2—SETTLING BASIN BETWEEN THE TUNNELS

1:1,200, and having a total length of 14,208 ft. The concrete lining of the tunnel varies in thickness from 0.7 ft. to 1.5 ft. depending on the geological formation.

Between the first and second section of the tunnel is a settling basin, shown in Fig. 2. Its approach channel has a gradually increasing width and depth and has two longitudinal diverging walls which direct and spread out the flow before it passes through a second set of trash racks into the settling basin. The main portion of the basin is 300 ft. long, 23 ft. deep and has an effective width of 68 ft. Four drains 0.25 and 0.30 ft. in diameter run lengthwise of this basin to valves opening into a wasteway. An overflow weir along the approach to the settling basin controls the flow through the second and longer tunnel.

Surge Basin—At its lower end the tunnel is increased in width from 15 to 20 ft. for a distance of 300 ft. before it enters a concrete surge basin built into the inside of the mountain above the power house. The basin is 86 ft. long and of a maximum width of 49 ft. Three baffle piers near the tunnel mouth distribute the flow from the tunnel and three 4x6-ft. siphon spillways discharge excess water into a 272-ft. spillway tunnel to a side valley. The surge height is 5 ft.

Trash racks protect the upper ends of the two penstocks. Flow of water into the penstocks is controlled by four segmental roller gates behind the trash racks.

The penstocks are of riveted steel pipe of an inside diameter of 9 ft. 4 in., a shell thickness varying from $\frac{3}{8}$ to $\frac{7}{8}$ in., and a length of 674 ft. Anchor blocks and expansion joints are located at the points of change of direction.

Power House—The power house contains two vertical Francis turbines of a total rated capacity of 19,800 hp., 250 or 300 r.p.m. depending on the cycles, generating alternating current at 6,600 volts. The net head is 262 ft. and the flow 1,300 sec.-ft.

The tailrace has a total length of 272 ft. The first 20 ft. is made up partly of open channel and partly of culvert, and the remainder is a tunnel 18 ft. wide and 12 ft. high.

General Contractors Review Major Problems

Sixth Convention Largest in History—Drastic Action on Surety Bonding—Code of Ethics Outlined—Winter Construction Boosted—Standard Contracts Advanced

ENCOURAGED by the understanding remarks of President Coolidge and his cabinet officers Hoover and Work who spoke to them, members of the Associated General Contractors in convention last week at Washington put through the committee reports and the program of special papers with remarkable dispatch. Besides much routine business, there were twelve standing committee reports and as many special addresses scheduled for the six-session program of the three convention days. No subject was dismissed before all the helpful discussion had been heard. Curbing the speakers could not be fully accomplished but usually the committee chairman was concise and discussion was confined to the question. This was no small accomplishment when force-account construction and contract-bonding practices were the subjects before the convention.

Routine convention activities may be dismissed briefly and attention given to the reports and the action taken upon them. As pictured in our news of the week George B. Walbridge, Detroit, Mich., was elected president of the association to succeed Frederick L. Cranford, Brooklyn, N. Y. H. W. Baum, Salt Lake City, Utah, was chosen vice-president at large. Sumner Sollitt, Chicago, and Godfrey Edwards, Los Angeles, were chosen vice-presidents. The following were named as directors: E. R. Shenk, Erie, Pa.; J. S. Crinkley, Memphis, Tenn.; F. M. Garthwaite, Charlotte, N. C.; H. S. Tullock, Leavenworth, Kan., and C. W. Lundoff of Cleveland, Ohio.

Suggestions made and policies outlined by President Coolidge, Secretary Hoover and Secretary Work in addressing the convention were followed in the resolutions adopted by the final business session. Among them were resolutions on seasonal fluctuation in construction; favoring a division of public works; condemning day labor; advocating apprenticeship training; for a code of contract laws; on railway legislation; on separate contracts; on bonding practices; and on lien laws.

During the year there has been a net decrease in membership due to the dropping of 652 names from the rolls for failure to pay dues or for other causes. The members added number 549, making the net decrease 103 and the present total membership 1,542. The proposal to change the association's name to Associated General Constructors was deferred for a year. A budget of $95,000 was adopted for 1925.

Public Service

If in periods of great business activity the work of construction might be somewhat relaxed; and if in periods of business depression and slack employment these works might be expanded to provide occupation for workers otherwise idle, the result would be a stabilization and equalization which would moderate the alternations of employment and unemployment.

Most forms of government construction could be handled in conformity to such a policy, once it was definitely established. Certainly in time of depression government can start building. This applies not only to the construction activities of the federal government, but to those of states, counties and cities.

Organizations such as your own represent possibilities of much good usefulness in dealing with all these problems. To the extent that they are devoted to such useful ends, they are entitled to all encouragement. In the construction industries, the movements to develop uniform contract forms promise much as an assurance of fair treatment to all competitors, and securing the best work.

If trade associations could be so conducted that the public might be assured of all their potential advantages, and at the same time safeguarded against the disadvantages incident to restricted competition and the exaction of too liberal profits they would render a large service to the community, and would be assured of a corresponding measure of confidence and support.

CALVIN COOLIDGE.

Action on Contract Bonding

Interest centered in the results of the conference inaugurated a year ago to consider reforms in surety bonding practice. The committee on insurance and bonds presented a summation of the action taken which was followed by a statement of action by the surety companies and by a resolution embodying the action of the convention.

Outline of Procedure—In January, 1923, the widely recognized need of co-operative action on this matter resulted in the proposal to call a Joint Conference composed of representatives from the American Association of State Highway Officials, the Surety Association of America and Associated General Contractors. The proposal was favorably received, and the conference held its meeting, June 7, 1924, at the Department of Commerce in Washington, where it was addressed by Secretary Hoover. Representatives of manufacturers of construction machinery and the Surety Agents' Association requested and were accorded representation in the conference. At this meeting those present aired their grievances, called attention to each other's shortcomings and finally paved the way to constructive action by appointing three committees to investigate the more important matters involved.

As the surety companies presented sufficient evidence to convince the conference that a reduction of premiums could come only after better underwriting practices had been established, the conference waived for the time being the question of premiums and took up its investigation of practices and their responsibility for the enormous losses. A resolution was passed urging elimination of the bidder's bond and definite subjects were assigned to the three committees for investigation and report at the second meeting held at White Sulphur Springs, W. Va., Sept. 20.

At the White Sulphur Springs meeting constructive action was recommended by the three committees on nine different subjects, the most important of which was the question of investigation bureaus and the means for determining the responsibility of constructors.

Upon practically all subjects except this one, the minds of the surety officials, engineers and constructors were in agreement. But upon the question of determining risks and the necessary procedure involved therein, there was much divergence of opinion among the surety men. The committee says:

In the opinion of this committee there are certain bonding officials who not only recognize the seriousness of the present situation, and their responsibility to the construction industry and to the public for correcting it, but are sincere in their efforts to do so. There is another group, however, which is unwilling to accept any responsibility, apparently thinking that engineers and constructors will eventually be worn out and that the present situation will then peacefully continue.

As a result of the White Sulphur Springs meeting, a resolution was passed referring the constructive measures proposed to the Surety Association of America for action. This resolution was as follows:

It is the sense of this meeting that the reports of committees one, two and three and the action here taken thereon be respectfully referred to the Surety Association of America, with request for an expression of its opinion and with the suggestion that as an initial step, the Surety Association of America inform this conference of its views and purposes, looking toward the active, prompt and effective establishment of local agency associations through the country and a corresponding denial of reinsurance facilities to nonconforming companies, it being understood that any well considered plan will have the support and cooperation of the other parties of this conference.

Surety Association Action—In conformity with the resolution of the joint conference the Surety Association of America on Dec. 18, 1924, passed the following resolution and statement of intentions.

Be It Resolved, That the Surety Association of America earnestly believes in the advisability of formulating a permanent joint conference body the membership of which shall be composed of committees representing the Associated General Contractors, The American Association of State Highway Officials, The American Institute of Architects, The American Society of Civil Engineers, and The Casualty and Surety Agents Association of America, and the Surety Association of America; that said joint conference body hold business sessions at regular intervals not less frequent than once every twelve months and that every effort be made to co-ordinate the activities of all parties to the joint conference in the work of eliminating the discreditable factors in the construction business.

Considering further action it was the view of the association that no inflexible rule can be made for determining the responsibility of contractors and the sufficiency of their bids for particular contracts; because such responsibility and sufficiency are composed of or affected by character, education, experience, industry, ability, finances, conservatism, plant, special advantages for particular jobs, and perhaps other variable elements; and we believe that responsible underwriters must independently judge for themselves and for the companies they represent the relative values of these different elements as the occasion may require.

It was further the view of the association that any plan having for its purpose concerted action by the surety companies, for the determination of the responsibility of specifically-named contractors, and of the sufficiency of their bids for particular contracts, would, for the reasons stated, be futile; and would be contrary to sound public policy, since it might in some cases, through error of judgment, result in discriminations and prevent the award of contracts to the lowest responsible bidders, thus entailing unjustifiable losses on such bidders and on the taxpayers.

The purpose of the association is to co-operate in the work of eliminating irresponsible contractors:

(a) By encouraging the organization of local surety agency associations at the larger cities throughout the country, where such associations do not now exist, and by urging the members individually of such associations to use the utmost care in the investigation of applications for contract bonds;

(b) By the appointment by this association of a Contract Bond Committee composed of a representative from each member company, such committee to be charged with the duty of investigating the subject of contract bond underwriting, and of recommending to this association standardized practices not inconsistent with the views hereinbefore expressed in connection with such underwriting;

(c) By the requirement by members of this association, wherever practicable, of the certification by public accountants of financial statements accompanying applications for contract bonds;

(d) By advocating the abolition of bid bonds.

(e) By the conduct by this association of a sustained educational campaign with the co-operation of the Committee on Better Underwriting, looking to a constant improvement in the quality of the contract bond underwriting of the members of this association.

Convention Action—In the discussion members generally expressed dissatisfaction with the action of the Surety Association and urged relief from the present situation by efforts in other directions.

Data and Ethics

Now, there are some problems that are peculiar to this industry, that I would like to see some development in. One of them is, I would like to see an independent investigation into the relative cost of construction of public works departmentally, as opposed to contracts. I believe that there would be here demonstrated a great public waste. It is in your interest to have that demonstration; and I suggest for your executive committee the consideration of the establishment of some investigation of that character. It is my own belief, as an engineer, that construction by contract of public works makes for national economy.

There are other problems in your industry which touch on ethics. Now, your association has made some progress in those directions. Many of the industries—many of the professions in particular—have gone further than you have; they have developed definite codes of ethics which are perhaps not always accepted by their members or followed any more than most people follow the Ten Commandments literally. But nevertheless, they have had a great influence by setting up a standard. There is nothing that advances conduct, character, morality, more than the erection of a standard, whether it is universally adhered to or not. The first requisite in advancing conduct is the establishment of a standard of morality.

HERBERT HOOVER.

Construction Practice

Day labor and winter operation received particular emphasis in several papers and in the reports of the committees on methods, construction and labor. In respect to day-labor it was estimated that some five hundred million dollars worth of construction is being

executed annually under the day-labor plan by public construction departments, which for one reason or another have sought to dispense with the services and the competition of private industry. There is unquestionably a certain amount of minor public construction and repair work which can be economically handled by the forces of a public body, but upon ordinary construction such practice cannot be justified. The wastefulness of such procedure, which lacks the driving force of individual initiative and financial reward for service is clearly understood by those having even a superficial knowledge of human tendencies and economics.

The matter is of such financial interest to constructors that they could well afford to maintain the services of several competent men who would devote their time exclusively to organizing the opposition to day-labor. To carry on this work effectively, it is advisable to interest other industries in the fight against elimination of private industry, and to utilize the efforts of local A.G.C. chapters. Various industries smaller than the contracting industry are spending more money than the entire A.G.C. budget to preserve, protect and extend their markets, and these industries are not confronted to any significant extent by a consciously directed effort to destroy their commercial existence.

In respect to seasonal operation the opinion was that though it is impossible to measure at this time the economy and the benefits to be brought about from continuous operation, it is so sound in principle that we need not wait for quantitative analysis before adopting winter construction as the customary procedure. To encourage this work the committee recommends that local conferences be held with architects and engineers, where the means may be found for placing before prospective owners the advisability of proceeding with their projects irrespective of the season. An important factor in this move will be the seasonal discounts which are already offered by various manufacturers. It may develop that these discounts will be instituted by other industries which will likewise profit from continuous operation.

Day Labor

It has been frequently stated that the government only gets sixty cents for every dollar it spends for public improvements. The reason given for this is that employees will not work as diligently for a municipality, a county, a state, or the national government, as for private employers under the eye of the master. It is also maintained that employees, particularly under the national government, are cloaked with civil service protection and are not required to exercise individual initiative or personal enterprise. With employees in private business a different situation exists. They must "deliver the goods" or get their time. They are constantly confronted with the possibility of losing their employment. For these reasons it is the policy of the Interior Department to let everything possible by contract on competitive bidding.

HUBERT WORK.

Legislation and Taxes

Legislation considered to demand the attention of the association includes: a federal Public Works Department; state laws requiring full cost reports of day-labor construction of public works; enabling laws for arbitration in public works contracts; repeal of lien laws; safety acts and codes; enabling acts permitting use of other surety on contracts besides corporate surety bonds and acts for licensing contractors.

Attention is also called to the fact that within the past year, the tax collectors of at least two states have found a possible new source of revenue in the collection of taxes upon construction materials assembled by constructors for incorporation into a construction project. The supreme court of Nebraska has held the constructor liable for such taxes on materials not yet incorporated into the work and the attorney general of Minnesota has given an informal opinion that such taxes were collectible up to the time of acceptance of the work.

As the contractor obviously does not own all of the materials, the unreasonableness of such a decision is apparent. It will evidently be necessary for constructors to ascertain which states collect such and to make provision in their contract for the cost where such collections in the future may be introduced. Information on this subject is being collected by the Washington office, which needs the co-operation of the membership to make it a complete survey of the situation.

Standard Contracts

After nearly three years of investigation, criticism and redrafting, the Joint Conference on Standard Construction Contracts consisting of representatives from the eight major architectural, engineering and contracting societies, issued in March, 1924, the third and final draft of proposed standard contracts for two major branches of construction. One of these is for building operations and the other for general engineering construction, both of which are applicable in their present forms to privately owned projects. By reason of established precedents, rulings and even laws governing public construction departments, some modification of the provisions of these contracts will usually be necessary on public construction.

The third draft of the conference documents has not yet been finally acted upon by the constituent associations but approval of these documents for the work to which they pertain will probably be forthcoming. This does not mean that each society will adopt the documents verbatim as they now stand, because they do not apply strictly to the work performed by some of these associations. However, approval as a statement of fair principles to which the construction world can turn for guidance, is expected.

At the last annual meeting of the American Institute of Architects, authority was given for the issuance of a fourth edition of their standard documents, which, they have stated, will be the building contract of the Joint Conference. Commercial distribution of this document is expected in February or March.

There are yet other documents to be produced covering other fields of construction and continuation of the conference is expected. An interest has been shown in its work by the American Society for Municipal Improvements, which is now working on a standard form of contract and has indicated its desire to affiliate with the conference and develop a form for municipal work, approaching the standard documents as closely as existing laws will permit. However, individuals are

not necessarily bound by the recommendation of their national association and constructors should increasingly work with local agencies to bring their contracts in line with the principles that have been approved by the conference.

The Interdepartmental Board of Contracts and Adjustments at Washington, consisting of representatives of those bureaus concerned with construction, has about completed a standard form of contract for federal construction. Work on this document was practically finished about Dec. 5 and the board has stated its expectation of having the document formally issued during the early part of 1925.

It was the stated intention of the board, which has worked in close contact with commercial organizations, to place governmental contracting practice as closely in line with commercial practice as existing laws would permit. In fact it is going even further in the matter than merely attempting to make the standard contract conform to the many varying laws and regulations. It is drafting a complete code of federal contract law to replace the hundreds of existing statutes, which now inject unnecessary cost into federal construction.

Ethical Practices Outlined

This year the committee came prepared with a formal code of ethical practices based on several years' committee work and a review by the executive board at its Des Moines, Iowa, meeting. As drafted the document comprises a declaration of principles, the code, and the rules of practice relating to owner and public, to engineers and architects, to sub-contractors and supply men and to operations in foreign territory. Discussion arose principally around the rules of practice numbering about a score, and various changes were suggested which will be taken under advisement before the code is drafted for adoption by the executive board. The general principles laid down were as follows:

1. Co-operation between constructors should be directed toward the improvement of construction methods, management and service, the elimination of uneconomical and improper practices, and the establishment of responsibility throughout their industry.

2. Competition in construction should be based upon quality of service as well as upon price, and every element of the industry should strive for the establishment of fair and scientific bidding practice.

3. Contracts, whether written or oral, should be carried out according to their bona fide intent, and any disagreement concerning that intent should be promptly settled, if possible, by impartial arbitration.

4. Seasonal and cyclical fluctuation in the construction industry, with their resulting waste, economic loss and unemployment, should be eliminated as far as possible through co-operation between constructors and other elements of the industry, and through education of the public.

5. Constructors, in recognition of the vital relation between their own welfare and success and that of their workmen, should in their dealings with labor be guided by principles of justice and fairness and recognize in this relation high standards of ethics, conduct, and craftsmanship.

6. A standard of construction service should be established which will give to the investing public an assurance of skill, integrity and responsibility from the construction industry.

Resolutions

As the sense of the convention on the issues raised by the committee reports and the discussion on the floor the following resolutions were voted:

Whereas, the Interdepartmental Board of Contracts and Adjustments of the United States is completing a proposed code of public contract law: *Be It Resolved* that the Associated General Contractors endorse the objects of the Interdepartmental Board and that this code of laws should be enacted without exercise of partisan politics and that it should receive the support of the entire commercial world.

That they urge upon members of Congress and the people of the country that all railroad problems as they arise be dealt with and settled as economic questions and not as political issues;

That there is no condition existing today which calls for any urgent legislative action by the federal Congress with respect to the railroads, either as to rates, labor relationship or valuation;

That adjustments in railroad freight rates and passenger fares should be left to the duly constituted government regulating bodies, where they will receive a full and fair hearing and an adequate economic analysis, and not be made the subject of direct legislative action; and

That a continuation of adequate transportation facilities and service necessitates adequate revenues in order that railroad credit may be restored and re-established in the confidence of investors and that ample additions, improvements and repairs may be made at reasonable financial costs.

That the Associated General Contractors use all legitimate and proper means to bring about the creation of a Department of Public Works in substantial accord with the recommendations submitted to Congress and commonly known as the Brown Plan, outlined on Chart B, Organization of the Executive Departments, Document No. 356, 68th Congress, first session.

That the practice of performing public construction work by the day labor method where a definite program with complete plans can be prepared in advance is unsound, wasteful and opposed to the best interests of the public, and That legislation should be introduced into Congress and the state legislatures requiring:

(a) The preparation of complete plans, specifications and estimates before any peace-time construction project is begun, with full publicity of same and of any changes subsequently made.

(b) A full and correct accounting of the cost of the work.

(c) Provision for publication of the actual and estimated cost, which shall be open for public inspection.

That the Associated General Contractors co-operate further with the Department of Commerce and Commercial organizations to eliminate seasonal habits in construction, and encourage more continuous operation throughout the year.

That the Associated General Contractors vigorously oppose the use of separate contracts and the enactment of any legislation to establish the use of such contracts by law.

That contractors in every state introduce into their respective legislatures a bill to prohibit public officials from acting as agents for surety companies, or from attempting to influence the placing of these bonds with any specific surety.

That legislation permitting optional use of other forms of surety be introduced into every state to break monopoly which has already been created for the corporate surety bond.

That this association will welcome a complete investigation of rebating by agents to contractors, public officials, owners and their representatives.

That the measures herein proposed be prosecuted with the utmost energy of this association, to the end that the entire group of surety officials be brought into effective co-operation with the leaders in their business who are willing to eliminate existing practices inimical to both public and private interests, and that this association continue to co-operate with any responsible groups interested in eliminating these practices.

That the Associated General Contractors, through its various publications and otherwise, oppose the practice of sales being made under the protection of lien laws in such states as the lien law now exists.

From Job and Office

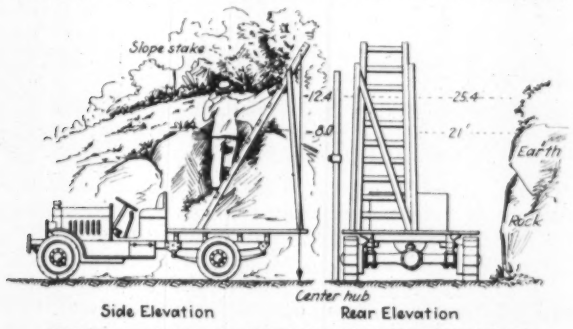
Hints That Cut Cost and Time For the Contractor and the Engineer

Ladder on Truck Facilitates Cross-Sectioning of Deep Cuts

By R. T. Brown
Civil Engineer, Greensboro, North Carolina

WHILE engaged in recross-sectioning a job recently I experienced considerable difficulty in securing elevations and distances from the center line of tops of cuts and rock ledges. The banks were too steep and the material in most places too friable to permit the rodman to climb the bank. To run a line of levels on the banks would have required considerable time and at that would not have helped in getting the distances from the center line.

It occurred to me that we needed a fire truck with an extension ladder. But not having one, we proceeded



VIEWS OF LADDER USED IN CROSS-SECTIONING

to rig up a ladder on a truck that was available, somewhat in the manner indicated in the accompanying sketch. This was so successful that the progress of the party was practically doubled.

Where the banks were not higher than the top of the level rod held on the center hubs, whose elevations had already been determined by means of a wye level, the observer stationed on the ladder stood in such position that his eye was level with the top of the bank, and read the height on the rod by means of the hand level.

In case the top of the slope was above the top of the rod but still within reach of the observer he stood with his eye on level with top of slope and read the rod set on the extended step, or bracket, and added the reading to the height of the step above the center hub.

To avoid keeping a chainman on the bank and having trouble getting the chain to him at each change from the left to the right side of the road, a hook was fixed in the top of a long light pole. The end of the chain held by means of this hook was easily kept at the desired point when securing distances from center. The pole was graduated from the top downward for several feet, so that in extreme cases where the observer could not climb high enough to hold his hand level in the plane of the top of the cut he could read his distance below the top on the graduated pole, which added to the height above the center hub gave the total height of cut. All the readings being plus, no computation for height of eye was necessary, and chances for error were diminished.

A plumb bob with a long cord was used when measuring distances, and when not in use was hung from a nail in the top of the ladder. For banks up to the height of the level rod measurements may be made from the rod without the use of the plumb bob.

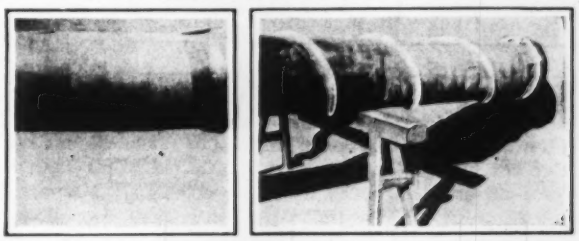
It is important that the ladder be placed on the left edge of the truck as shown to allow the observer to get over the center when making measurements, and avoid interference with traffic by keeping the truck on its proper side of the road.

External Protection for Steel Water Pipe at Shanghai, China

By W. W. Monk
Foreman Pipelayer, Shanghai Waterworks Co.
Shanghai, China

AFTER having found that protecting the exterior surface of steel water mains with hot pitch tar and a wrapping of "Hessian" does not give full protection against corrosion, due to the admission of moisture to the pipe through small holes caused by air bubbles and through sun cracks, I have used with success (1) a rubber solution; (2) a special wrapping and (3) bitumen paint. The protection, which was applied to a 20-in. steel pipe laid in slack and ashes, has given satisfaction. The details are as follows:

The pipe was thoroughly cleaned with steel wire brushes and a good coat of bitumen laid evenly over the surface and allowed to dry hard. A special coating of rubber solution was put on and allowed to dry for one day. Care was taken not to damage the first coat. The wrapping was started at the socket and worked toward the spigot end. The wrapping agent was a



COATING AND HANDLING STEEL WATER PIPE AT SHANGHAI, CHINA

Left: Overlapped wrapping of special form of roofing material. Right: Rope to protect coating from damage while being moved over ground.

specially made semi-rubber malthoid roofing material, which is more pliable and elastic than malthoid itself. The wrapping strip was pulled tight and bound around evenly, leaving a ½-in. overlap at every turn (Fig. 1). The overlaps were repainted with bitumen so as to prevent leakage occurring between them. When the spigot and socket were ready to be calked small strips were cut and treated in the same manner. Where the

pipe was to be hauled a considerable distance a 1¼-in. diameter rope was wound around it to protect the coating.

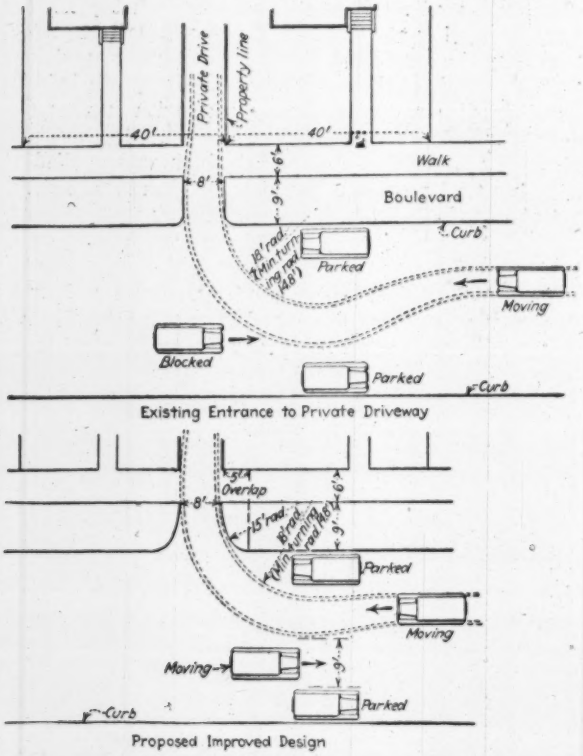
It is important that the primer coating be of pure Trinidad bitumen, as there are many bituminous paints on the market which are mixed with ingredients that are not suitable for coating steel or iron pipe. Great care should be taken that the elastic properties of the pure bitumen are not impaired, thus guarding against blistering, cracking or flaking off, also ensuring the unity with the metal surface to which it is applied for the prevention of formation of rust underneath.

The first cost of this method of protecting the outer surface of steel pipe is a little more than some others but it saves money in the long run. One disadvantage of the method is that it cannot be hurried; nor can it be used in rainy weather unless the work is done under cover.

Design of Private Drive Entrances in Relation to Street Traffic

BY GEORGE H. HERROLD
St. Paul, Minn.

THE city of St. Paul is beginning to make a careful study of its engineering standards to see how they may be changed or corrected to insure a greater safety for vehicles. The accompanying illustrations show a



OLD AND IMPROVED DESIGNS FOR PRIVATE DRIVEWAY ENTRANCES AT ST. PAUL, MINN.

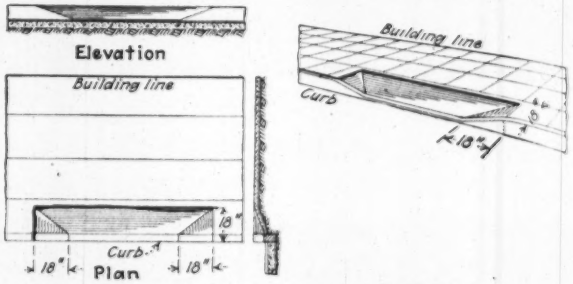
study made of the path of a car entering a private driveway and the flare that must be given to such a driveway to keep the average car on its own side of the street. By enlarging the entrance to private driveways in this manner when streets are paved or boulevards are improved one of the sources of great danger is removed from the streets.

From Job and Office

Hints that Cut Cost and Time

San Francisco Standardizes Auto Runways Crossing Sidewalks

UP TO THE present time automobile runways have been constructed across sidewalks and parking strips with little supervision by city boards of public works. In San Francisco complaints have been registered from time to time that these runways are a



DETAILS OF AUTOMOBILE RUNWAY

menace to pedestrians and others, and in case of injury a claim for damage might be made against the city. For the purpose of vesting authority to supervise this form of construction plans and specifications for runways have been prepared by the San Francisco Board of Public Works and approved by an ordinance of the Board of Supervisors.

The manner in which such runways are to be constructed is indicated in the accompanying figure.

Contractor's Improvised Suspension Bridge

THE SUSPENSION foot bridge of 125-ft. span, shown in the accompanying view, was improvised for the use of workmen on a highway bridge contract in Indiana. Its construction saved much time otherwise lost in continual rafting or ferrying across during the construction work.

Pairs of trees conveniently located formed the towers, to which two ¾-in. cables were wrapped and secured by clips. Hangers composed of single ⅝-in. rods carried 4x4-in. stringers in 12-ft. lengths. Each rod had a looped end to hold the cable, and at the lower end was a form clamp, under the stringer, which facilitated

SUSPENSION FOOTBRIDGE FOR WORKMEN

From Job and Office

For Contractor and Engineer

making the adjustment for height. These hangers were about 4 ft. apart. Upon the stringers were placed cross pieces to carry a runway composed of two lines of plank. Inclined planks with cleats formed the approaches. The cable sag was about 36 in. It was estimated that this bridge could safely carry a load of 2,000 lb., but its flexibility made walking more or less difficult.

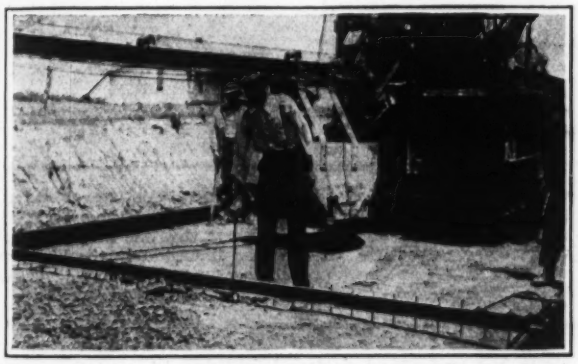
The bridge was designed by W. H. Kirven, superintendent of construction for the F. K. Vaughn Building Co., Hamilton, Ohio, on its contract for a series of concrete bridges south of Seymour, Ind., for the Indiana State Highway Department.

Improved Subgrade Templet

By Herman A. Blau
Resident Engineer, Illinois Division of Highways, Bloomfield, Ill.

THE accompanying photograph shows an improved, all-steel, subgrade templet used by a paving contractor on Illinois work. It consists of a 4-in. channel having ¾-in. round rods inserted through holes in the channel flanges at 6-in. intervals and held in place by hook bolts in the web. The channel is supported on the road forms by 12x3-in. shoes which prevent the templet from tipping readily.

Since the stiffness of the channel prevents all sag



ALL-STEEL SUBGRADE TEMPLET

due to its own weight when in place, it is a simple matter to set or check the setting of the prongs. This is accomplished by measuring down from the bottom or top of the channel to the end of each prong the required subgrade depth for each corresponding 6-in. point across the subgrade.

Compared to the usual wooden templet the above type has the advantage of being practically indestructible, is accurate and easily adjusted or checked, and due to its greater weight will not "ride" the subgrade but will leave marks on the hardest clay.

The templet was originated by Everette Prosser, superintendent for C. E. Hamilton, contractor, of Carbondale, Ill. It has been used by him for two seasons with satisfaction and is still good for several more seasons.

Practical Use of Mathematics as Aid to Culvert Headwall Estimating

By George D. Burr
Assistant King County Engineer, Seattle, Wash.

MATHEMATICS is useful to an engineer only to the extent that he is able to apply his knowledge to concrete facts. Calculations of similar kind are repeatedly made when an easily developed curve or formula would solve the problem quickly. In culvert design, for example, it is always desirable to have a standard design accompanied by a tabulated list of quantities of concrete and steel per unit length of box

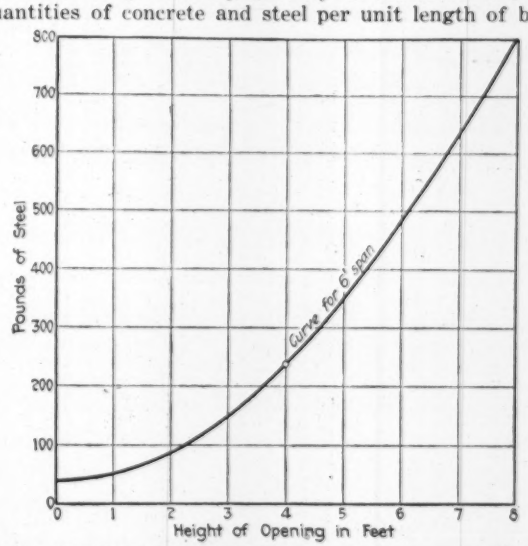


FIG. 1—POUNDS OF STEEL FOR VARIOUS OPENINGS IN CULVERT HEADWALL OF 6-FT. SPAN

and headwall for the various sizes of culvert likely to be used. The quantities per lineal foot of box are readily obtained by direct calculation. The quantities of concrete and steel in the various sizes of headwall are more difficult to calculate. A simple method for steel calculation is herein explained.

It will be noted that steel in the wing walls varies with both the height and width of the opening, because the thickness of the deck increases with the width, and consequently the height, width of footing and length of the wing wall increase with the width of the culvert opening. The apron quantities also vary with both the height and width of opening. These facts necessitate independent calculations involving an hour to two hours time for each size of culvert contemplated for the purposes of the table, and for any other sizes of culvert that might happen to be used. There are thirty-four quantities desired for the table, which would take a minimum of fifty hours or upward of a week to calculate and check. That is too much time.

To facilitate the solution of the problem analytical geometry is relied upon. It is obvious that if a curve is drawn from which quantities may be taken off directly, there will be as many curves as heights or spans. Inasmuch as any one of an infinite number of either may be used, it becomes apparent that such a direct reading curve cannot be used. Therefore, a formula is developed in which a few simple values may be substituted and the result easily obtained.

First, calculate directly the steel in the culvert headwall of the 6-ft. span having heights of 0 ft., 4 ft. and

8 ft. Plot these on a sheet of cross-section paper having pounds of steel as ordinates and culvert heights as abscissas, and observe that a smooth curve through the points so plotted takes very nearly the form of a parabola. However, it is obvious that the steel in a headwall of 6-ft. span does not vary as the square of the height, and also that for zero height the curve does not run through zero. Therefore, use the general formula for a parabola, modified by using the exponent n instead of 2. The formula so used is as follows:

$X^n = 2p(y - b)$, in which X = the height of the culvert opening; y = the pounds of steel; and n, p and b = parameters, constant for any given span.

In the above equation there are three unknown quantities besides the height of opening and the pounds of steel for any given span. It will be noted above that the quantities of steel for the 6-ft. span for height of 0, 4 and 8 ft. have been calculated directly, the results being 40 lb., 237 lb. and 810 lb. respectively. Substituting these values in the equation, and pointing off two places in order to avoid numerically large values of p and b, we have three simultaneous equations:

$$0^n = 2p(0.40 - b)$$
$$4^n = 2p(2.37 - b)$$
$$8^n = 2p(8.10 - b)$$

Solving the equations we obtain the following values:

$n = 1.967, \quad p = 3.877, \quad b = 0.40.$

Now refer to the sheet containing the parameter curves (Fig. 2). Numerical values of n, p and b are plotted as ordinates and spans of culverts are plotted as absissas. The values of n, p and b obtained above for a 6-ft. span are plotted thereon. Similarly, the pounds of steel for 0-, 4- and 12-ft. heights for a 10-ft. span are calculated directly and the parameters $n = 1.757$, $p = 2.139$ and $b = 0.88$ calculated and plotted. Likewise, values of n, p and b are obtained for a 3-ft. span. More values of the parameters might be obtained but these three values each of n, p and b, ranging from the smallest size of culvert to the largest likely to be used, are sufficient. Now draw smooth curves through the values so obtained.

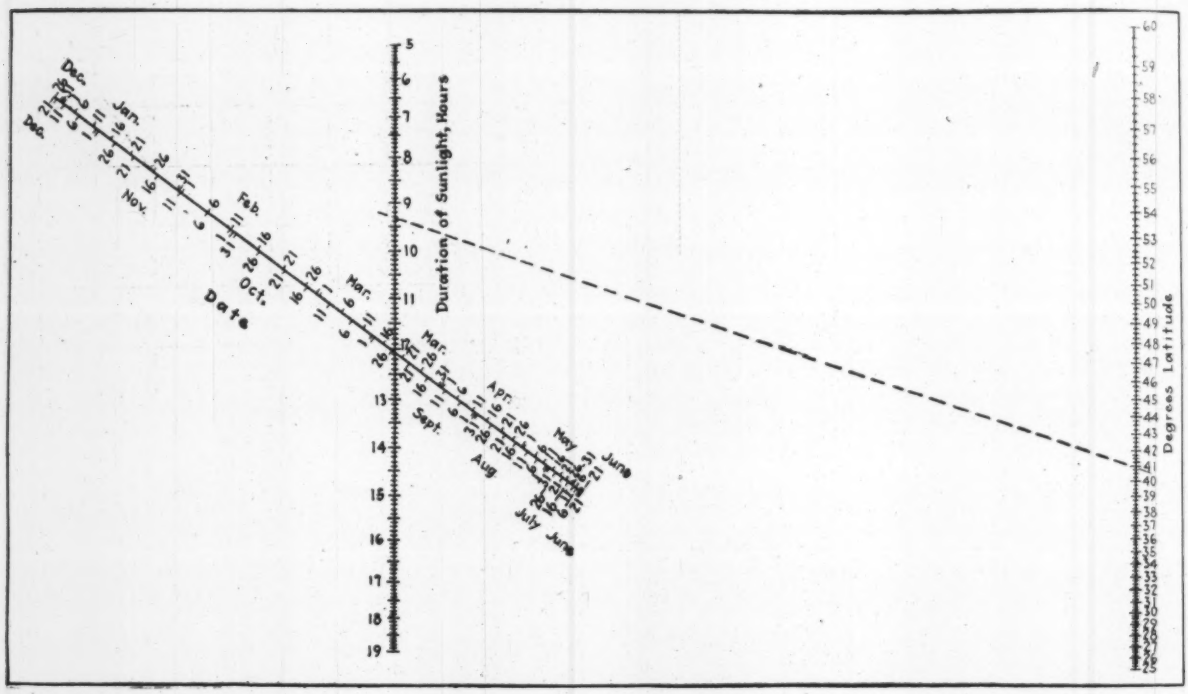
The equation $X^n = 2p(y - b)$ is now transformed to $y = \frac{X^n}{2p} + b$. The values of y (pounds of steel per culvert headwall) should be multiplied by 100 in order to compensate for the previous pointing off of two places in the development of the formula.

The preliminary work is checked by comparing the values obtained from the formula with those previously obtained by direct calculation. All of the quantities of the steel for the various culvert sizes are now

From Job and Office

Hints that Cut Cost and Time

Nomogram for Determining Hours of Sunlight



THE accompanying nomogram was taken from a recent issue of *The Canadian Engineer* where it appeared as part of an article on "Study and Problem of Urban Growth." The nomogram was devised by the topographical survey branch of the Canadian Department of the Interior. It gives results for all places between latitudes 25 deg. N. and 60 deg. N. It is used as follows: Select on the latitude scale the latitude of the particular place considered, drawing a line from there to the day of the month on the date scale, when the computation is made. Where this line intercepts the vertical line to the left one can read immediately the hours of sunlight. Thus, as shown on the chart, on Christmas day New York City has about 9 hr. 40 min. of possible sunlight.

From Job and Office

For Contractor and Engineer

calculated. This work is rapidly checked with sufficient precision by plotting the values so obtained as ordinates with the span as abscissas and drawing smooth curves through the values for the same span. If one of the quantities is irregular there has been some error made in its calculation.

The following will show how simple the calculation of steel by the formula is. To find the steel in one headwall of a 6x7-ft. culvert:

$$X = \text{height} = 7$$

N, p and b are read from the parameter curves for a 6-ft. span and are respectively 1.967, 3.88 and 0.40. Substituting these values in the formula we have:

$$y = \frac{7^{1.967}}{2 \times 3.88} + 0.40$$

$$y = \frac{45.952}{7.76} + 0.40$$

$$= 5.92 + 0.40$$

$$= 6.32$$

Therefore, there are 632 lb. of steel in one headwall of a 6x7-ft. culvert.

It will be noted that we have calculated directly the steel in the headwalls of nine different culverts, which together with the other calculations and plotting will

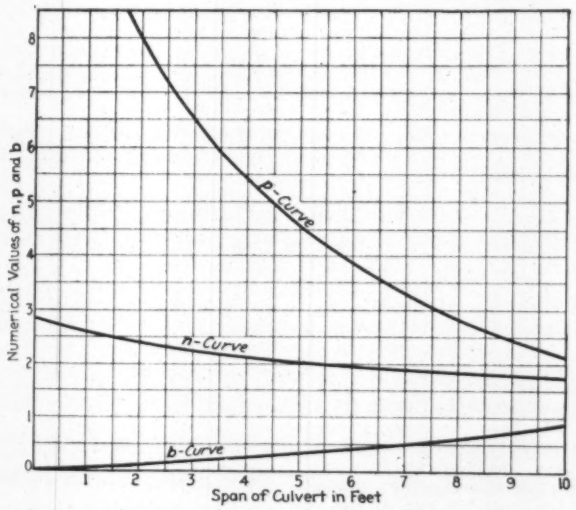


FIG. 2—FORMULA FOR CALCULATING POUNDS OF STEEL IN STANDARD CULVERT HEADWALL
Values of n, p and b are substituted in the general formula.

not take in excess of 12 hours time. We are then prepared to calculate all of the remaining steel quantities at a rate of not to exceed six minutes per culvert. In other words, we are able to calculate all the remainder of the culverts with greater accuracy than we otherwise would be able to and to completely check our work in four hours. The total time spent in making and checking the calculation by this method is not to exceed 16 hours or two days, which is less than one-third of the minimum time required to make direct calculations.

Concrete Piles Built Under Pressure

CONCRETE piles are being built by a pressure method in England, according to London *Engineering*. In this method steel cylinders of internal diameters ranging from 10 to 20 in. are sunk either by ordinary well drilling methods or hydraulically. When the cylinder has reached its required depth the drilling apparatus is removed and reinforcing material lowered into place. A flanged cap having three pipe connections is then placed on the top of the cylinder. From one of the pipe connections a pressure pipe extends to the bottom of the excavation while a second connection admits compressed air to the interior of the tube to force the water out of the cylinder and of the earth surrounding its lower end. When this has been accomplished cement mortar is forced through the pressure pipe until the cylinder is filled to a level sufficient to balance the pressure of the subsoil water. The inflow of cement is then stopped and air pressure at 140 lb. per square inch admitted through a third connection in the top cover. This forces some of the cement out of the lower end of the cylinder and drives it into the surrounding soil, forming a club-foot for the pile. After the foot end has been made more cement is forced into the cylinder and then the air pressure is increased until it is sufficient to begin forcing the cylinder up out of the hole. As this movement continues more cement is added until the hole is completely filled. The pressure which raises the cylinder from around the freshly poured concrete core also results in forcing the concrete into the annular space left by it and into cavities in the surrounding soil. This method has been perfected by the Pressure Piling Co., Ltd., of London, England.

Baffle Breaks Up Lumps of Clay

IN ORDER to give an additional wash to the material which is mined without stripping and consequently contains considerable clay and loam, the Wolf River Sand Co. of Memphis, Tenn., has devised a circular baffle, shown in the accompanying photograph, to place on the end of the discharge pipe. Much of the clay is in hard lumps of considerable size and in order to deal with these the baffle has been devised. There is a central plate 2 ft. in diameter against which the discharge strikes, and two concentric rings. The larger lumps of clay are caught by these rings and held by them until disintegrated by the pounding of the stream. The information contained in this article was taken from an issue of *Rock Products*.

Letters to the Editor

This department aims to be a forum for the discussion of the views of engineers and contractors. The range of interest should be as wide as possible. Contributors are, therefore, asked to make their letters short.

Reasons for Using Gravity Dam at Black Canyon

Sir—The undersigned has read with interest the description of the Black Canyon dam in Idaho, designed and built by the U. S. Reclamation Service and described in your issue of Nov. 20, 1924, p. 818.

It is unfortunate that a reinforced-concrete-slab type of dam was not adopted for this site. The natural conditions are ideal for such a dam. The foundation of solid rock of high bearing value at a reasonable depth below the surface could hardly be improved upon. Grouting the foundation to guard against upward water pressure would have been avoided, as it is impossible to get overturning due to upward water pressure with the reinforced-concrete type of dam the writer is referring to.

There would have been a great saving in the amount and cost of excavation and of concrete. Judging solely by the information given in the article there would have been a saving in cost of not less than $150,000. There would have been less than one-third the volume of concrete to handle. Speed was a vital consideration in the construction of this dam. The farmers were in danger of ruin by reason of threatened water shortage. A great saving in time of construction would of course be the result of the great savings in the amounts of excavation, concrete and concrete materials.

It would seem that the time element alone should have been a controlling factor in choosing reinforced concrete for this dam. When the reduced cost and the added safety of the reinforced-concrete structure are also thrown in the balance against the gravity type of dam, it would seem that reinforced-concrete construction had all the advantage on this project.

WALTER H. WHEELER,
Designing and Consulting Engineer.

Minneapolis, Minn.
Nov. 29, 1924.

Sir—Replying to Mr. Wheeler's letter on the Black Canyon dam, before selecting the gravity type dam careful studies were made of several different alternative types, including a reinforced-concrete dam. These studies were considered by a board of engineers, and the reinforced-concrete dam was rejected, for the following reasons:

(a) The estimated cost of the reinforced-concrete dam was only slightly less than for the gravity dam. This was due, in part, to the fact that the abutment sections of the dam were located on rather narrow ridges, requiring much lower foundations for the wider reinforced-concrete dam than for the gravity dam. Another advantage of the gravity dam was the simple and inexpensive method of providing the discharge pipe for the pumping plant by merely coring a hole in the top of the dam and reinforcing it for the water pressure.

(b) The adaptation of drum gates to the reinforced-concrete dam proved to be very complicated and expensive, practically precluding the use of this type of gate for the spillway section of the dam. The drum gates were considered the most suitable type of gate for passing the heavy ice flows which frequently occur in the Payette River.

(c) Winter temperatures at the site of this dam are severe, and as the reservoir will be kept full throughout the winter season for power use, any thin reinforced-concrete dam would be subject to serious damage from frost action on saturated concrete. In this connection Mr. Wheeler should investigate the recent experience of one of the large power companies with a reinforced-concrete dam situated at a high elevation in the Sierra Nevada of southern California. This dam, built in 1917, has been so seriously damaged by frost action that it has recently been converted into a semi-gravity structure at great expense.

(d) The conditions at the site of this structure were particularly favorable for mass concrete work. Sand and gravel for concrete were available within about one mile haul from the dam and cement was delivered by railroad to a siding under the construction cableway. A large yardage of mass concrete in the river section of dam was within chuting distance from a 100-ft. trestle from the mixing plant. Mass concrete was more easily protected from freezing than reinforced concrete. The average cost of $7.55 per cu.yd. for mass concrete as compared with the cost of $21.40 for reinforced concrete will indicate about the ratio in unit costs which would obtain between the gravity dam and a reinforced-concrete structure. These units applied to the differential in quantities suggested by Mr. Wheeler will show only a small difference in cost in favor of the reinforced-concrete dam.

J. L. SAVAGE,
Designing Engineer, Bureau of Reclamation.

Denver, Colo.,
Dec. 8, 1924.

Ratio of 7-Day to 28-Day Concrete Strength

Sir—In *Engineering News-Record*, Nov. 27, 1924, p. 879, there appeared a formula suggested by the Bureau of Standards for figuring the 28-day test strength of concrete from the 7-day break. This seems to hold true in a few of our recorded breaks, but not enough to justify much confidence in it. From our records of cylinders cast on concrete construction in Oregon, the ratio of 28- to 7-day breaks varies from 1.51 to 2.16.

The temperature and possibly other factors enter into the rate with which concrete sets. In the spring and fall with their attendant cold days, and cooler nights, concrete seems to gain its strength more slowly, in which case the 28-day break is apt to be about 1.9 times the 7-day break. Conversely in warm weather the 28-day breaks may drop as low as 1.5 times the 7-day breaks. However, I believe that other conditions may largely influence, such as the materials used, and the difficulty of obtaining two cylinders from the same batch exactly alike, especially where the coarse material in the mineral aggregate is rather large.

The rate of set (by this I mean the rate at which the concrete and mortar gain strength) is partly combatted by the particular characteristic of the cement used. Some cements gain strength gradually while others gain their strength more rapidly, under the same conditions of curing.

N. M. FINKBINDER,
Engineer of Material, Oregon State Highway Commission.

Salem, Ore.,
Jan. 6, 1925.

Ice Thrust on Tall Piers

Sir—I note a comment in *Engineering News-Record* of Dec. 4, 1924, p. 924, by T. E. Moss Wheat with reference to ice shove on the high bridge piers of the Kennedy Bridge, Kentucky Hydro-Electric Co., described in *Engineering News-Record* of Nov. 6, p. 757.

The resisting moment against overturning of the higher of these two piers, 222 ft. high, is 49,600,000 ft.-lb. in a direction at right angles to the center line of the bridge and 30,800,000 ft.-lb. in the direction of the bridge. Both of these resisting moments are based upon reduction in weight of the concrete to allow for full buoyant effect of the submergence in water.

These resisting moments are equivalent to horizontal loads at the top of the pier in the amounts of 224,000 lb. in a direction at right angles to the bridge and 139,000 lb. in the direction of the bridge. The maximum horizontal load at the top of the pier, due to wind against the bridge spans, is 90,000 lb., which deducts from 224,000 lb., leaving about 134,000 lb. laterally and 139,000 lb. (less the longitudinal wind and friction of rollers) longitudinally to resist ice or the dynamic pressure of flowing water.

The maximum velocity of the water under extreme flood conditions will be only about 0.5 ft. per second, which is almost negligible. A horizontal load of 134,000 lb. from ice shove exerted against a semi-circular face of the pier, which is 12 ft. thick, would provide for an ice pressure of about 11,000 lb. per foot of projected width of pier in the direction of the river, and 139,000 lb. distributed over the width of the pier in the other direction; 22 ft. would provide for 6,300 lb. of ice pressure per foot of projected width normal to the direction of the river.

It is our observation that the period of freezing over of

a deep lake lags a considerable time after the average daily air temperature has dropped to the freezing point or below. The winter season is the rainy season in central Kentucky and the Dix River at that time is subject to frequent large freshets which would replenish the surface of the reservoir with water higher than freezing temperature. Cold waves which may drop to several degrees below zero in exceptional cases are usually of short duration, and it is our belief that very thin ice, if indeed any, will form on the Dix River reservoir, unless in shallow arms of the reservoir, and that the above allowances for ice shove are therefore ample if not excessive.

L. F. HARZA,
Consulting Hydro-Electric and Hydraulic Engineer.

Chicago, Ill.,
Dec. 20, 1924.

Poor Form Setting on Concrete Roads

Sir—Now that "finis" has been written on the concrete road construction in the northern states for the 1924 season, engineers, contractors and equipment manufacturers will have a few moments to sit down and calmly survey their efforts of the year. This would be a good time for them to give some consideration to the matter of preparing the grade and placing the forms for concrete roads.

There is much exclamation over the very bad form setting that has been going on for some time, and that has been the cause of practically all of the wavy surfaces in concrete roads. Bumps here and there are explainable by the difference in the consistencies of batches of concrete as they come from the mixer, and by stone pockets that occur here and there that do not subside equally with the surrounding concrete during the period of early setting, but waves across the road are caused by bad form joints.

The writer has been on many concrete road jobs in several states this year and has seen forms so poorly set that nothing but a poor riding road surface could come from any method of finishing. Inspectors seem to pay little attention to the setting of the forms and the contractor's organization, which must be a hustling one to get production on a concrete road job, does not stop to correct such a seemingly small thing as a poorly set form line, unless the inspector insists upon it. It would seem that inspectors could be instructed to watch the form setting and see that each section of form has a level and firm foundation under the whole width and length of its base, that the tops at the joints are even and that the whole form line is brought to an even grade. We can't expect to have a concrete road surface any smoother than the top of the form line to which it is finished, and it is high time that some vigorous methods be used to insure a proper and stable setting of forms.

A SUBSCRIBER.

Cleveland, Ohio,
Nov. 26, 1924.

Successful Operation of Time Charge in Construction Contracts

Sir—I was much interested in the article written by Henry H. Quimby, consulting engineer of Philadelphia, which was published in your issue of Dec. 18, 1924, p. 989, regarding the use of a time charge to replace the bonus and penalty clauses in construction contracts.

My firm has been using the same method with gratifying success since 1920. We cover this provision in a form somewhat more condensed than that used by Mr. Quimby but so far not the least difficulty or controversy has ever arisen in our work. Our experience with this kind of clause now covers perhaps thirty or forty contracts.

The whole matter is taken care of in a clause of the contract and a clause of the proposal form. The contract reads as follows:

"It is mutually agreed that time is of the essence of this contract and that the owner is put to considerable expense while construction is under way and will suffer monetary damage in the event of delay in the completion of the work. For these reasons, and also in order to place all bidders on an equal basis as to the actual cost of the work (including the time element) to the owner under their respective bids, it is agreed that the sum stated in the proposal shall be deducted from the moneys otherwise due or to become due the contractor for the time elapsing between the date of starting field construction and the date of actual completion, not as a penalty but to indemnify the owner on account of said expense; provided however that no such deduction shall be made for time during which the work is discontinued for any continuous period exceeding one week on account of the weather, acts or negligence of the owner or causes beyond the contractor's control."

The bidding form provides the following, and this provision is placed at the end of the form just above the contractor's signature in order that it will be sure to be heeded in the making up of proposals:

"The bidders' attention is called to that clause of the contract which requires the deduction of a certain stipulated sum while construction is in progress and it is hereby agreed that the sum so to be deducted shall be $——— per month. It is understood that the cost to the contractor of meeting this provision has been included in the various prices bid."

In case a bid is made on more than one proposition, this clause in the bidding form further provides that this sum will be deducted from each proposition regardless of whether they are let to the same or to different bidders, and in some cases the amount to be deducted each month varies for the different propositions because it would of course not be suitable to make a relatively large deduction for a relatively small contract.

Our method regarding the contract dates for starting and finishing the work varies from that used by Mr. Quimby. We usually leave these dates to the bidder except when, for some local reason, a definite date of completion is mandatory. By this means, we believe that better bids are sometimes received because it enables contractors to suit their own convenience, which frequently is of considerable importance to them when planning ahead for the continuous use of their plant and equipment.

There was some opposition at first among contractors to this clause but the opposition was entirely theoretical and not always on the same grounds. There never has been any dissatisfaction with this clause on the part of contractors who actually did work under it and their experience apparently has allayed all misgivings on the part of those contractors who may at first have been skeptical.

ARTHUR S. MILINOWSKI,
Druar & Milinowski, Consulting Engineers.

St. Paul, Minn.,
Dec. 29, 1924.

Bonding of Alumina to Portland Cement Concrete

Sir—Perhaps the following experience with alumina cement will have some practical bearing on the discussion as to whether alumina cement concrete will adhere to portland cement concrete.

During the early fall, the writer directed the use of alumina cement for concrete for the construction of a part of a boiler setting, and for a track slab. Part of the boiler setting had been concreted when one boiler arrived on the siding and it was necessary to secure early strength in the balance of the work so as not to delay the boiler contractor. The bond between the two concretes is apparently as good as we are accustomed to get, and in one place in particular, at the third-point in a T-beam, there is no apparent evidence other than color that the concretes were poured on different days.

Following this experience and after some test results were known, a slab of alumina cement concrete having a depth of 15 in., a span of 7 ft. 0 in., and 9 ft. wide, was cast in the top of a conveyor underpass tunnel poured the previous day, using portland cement, and the next day a switch engine and cars passed over the slab without other support than the usual 4 x 4's necessary to support the forms during concreting. It was not certain that perfect bond (adherence) would result between the two concretes and a slot was left along the upper half of the juncture plane to be filled with pitch in case a crack should develop between the surfaces. Although the slot has never been filled, there is no evidence of any other leakage than usually shows along fresh construction joints, and that only on one edge.

H. W. HAY,
International Motor Co.,
Plainfield Plant.

Plainfield, N. J.
Dec. 22, 1924.

News of the Week

CURRENT EVENTS IN THE CIVIL ENGINEERING AND CONTRACTING FIELDS

Robert Ridgway Elected Am. Soc. C. E. Head

Chief Engineer of New York Board of Transportation Has Served City Many Years

Robert Ridgway, elected president of the American Society of Civil Engineers yesterday morning, at the opening session of the annual meeting, New York City, was born in Brooklyn, N. Y., Oct. 19, 1862 and educated in public schools and at home. He started his professional career at the age of 20 as a chainman, rodman and instrument man on reconnoissance surveys in Montana and later on location and construction of the Wisconsin Division of the Northern Pacific R.R. Since 1884, when Mr. Ridgway returned from the West, he has been in engineering work in New York City almost exclusively.

In 1886 he was made assistant engineer of the Aqueduct Commission of New York City on the location and construction of the aqueduct and of the dams, reservoirs and appurtenances of the Croton system. From May, 1900 to August, 1905 Mr. Ridgway was with the Rapid Transit Railroad Commission of New York City, entering as senior assistant engineer in the Second Division which comprised the construction of that part of the first four-track subway from 41st St. and Park Ave., Manhattan, through 42d St. to Broadway and north under Broadway to 104th St. In March, 1903 he was appointed division engineer and placed in charge of the Fifth Division, which included Sections 2, 2A and 3. This latter section included the Battery-Joralemon St. Tunnel, the first rapid-transit tunnel under the East River.

Mr. Ridgway joined the New York Board of Water Supply in September, 1905, when that body was created by an act of the New York State Legislature to provide an additional supply of water for New York City. As division engineer he was assigned to studies including those for an aqueduct of a daily capacity of over 500,000,000 gal. In the spring of 1906 Mr. Ridgway was promoted to department engineer and placed in charge of the construction of the Northern Aqueduct Department which included the northerly sixty miles of the Catskill Aqueduct, about two-thirds of which department was west of and one-third east of the Hudson River. The crossing of the Hudson River by means of the rock pressure tunnel, 1,100 ft. below the river surface, was in this department.

In January, 1912 Mr. Ridgway was made engineer of subway construction for the Public Service Commission for the First District, State of New York, in charge of the supervision of construction of the new rapid-transit subways and elevated lines in New York City, including five tunnels under the East and Harlem Rivers. The complete system, old and new, comprised 620 single-track miles and the city-owned portion represents a construction cost of over $300,000,000. Mr. Ridgway continued in this position under the office of the Transit Construction Commissioner, successor to the Public Service Commission for the First District. In May, 1921 he was appointed chief engineer of the Transit Commission, successor to the office of the Transit Construction Commissioner.

On July 1, 1924, Mr. Ridgway was made chief engineer of the Board of Transportation of the city of New York.

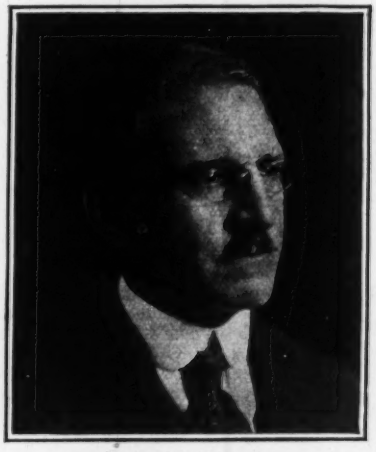
Mr. Ridgway was a director in 1911-1913 and a vice-president 1922-1923 of the American Society of Civil Engineers. Among numerous technical societies he holds membership in the Institution of Civil Engineers (Great Britain), Franklin Institute, New England Water Works Association, American Society for Municipal Improvements, American Association for the Advancement of Science, and others.

Engineering Fifty Years Ago

From *Engineering News*, January, 1875

RAILROADS are to connect the large cities of this continent, located, equipped and operated to maintain a speed of 100 miles per hour with safety and certainty.—A paper by Martin Coryell, at the annual convention of the American Society of Civil Engineers, Louisville, Ky., May 21, 1873.

New President of American Society of Civil Engineers



Robert Ridgway

Am. Soc. C. E. Board Approves Model Registration Law

The Board of Direction of the American Society of Civil Engineers, meeting Jan. 19 and 20 prior to the opening yesterday of the annual meeting of the society in the Engineering Societies Building, New York City, formally approved an act for the registration of engineers, drawn up after several years' consideration. The act will be the recommended form for licensing laws where legislation of the sort is now pending, and copies of it will be forwarded, in advance of its publication in *Proceedings*, to local sections of the society, its membership and various state legislatures. This special action was taken by the board so that legislatures now in session will have the benefit of study made on licensing by the society's special committee, of which T. L. Condron, of Chicago, is the chairman.

The board approved the petition of 15 corporate members of the society residing in the state of Arizona for a charter establishing the Arizona section of the society. It also granted charters to two more student chapters —one at Armour Institute and the other at the University of Georgia.

John F. Stevens Is Awarded John Fritz Gold Medal

The twenty-first annual award of the John Fritz gold medal awarded for notable scientific or industrial achievement, was made Jan. 16 to John F. Stevens, of New York City, for great achievements as a civil engineer, particularly in planning and organizing for the construction of the Panama Canal; as a builder of railroads, and as administrator of the Chinese Eastern Ry.

Mr. Stevens, one of the most widely known and highly esteemed of American civil engineers, is known especially for work on the Panama Canal, the American Railway Mission to Russia, and construction and operation of important railway systems in the United States. He is an honorary member of the American Society of Civil Engineers, and of the Association of Chinese and American Engineers, Pekin. He is also member of other American and foreign engineering societies.

Mr. Stevens, as head of the American Railway Mission to Russia, 1917-1918, rendered heroic service toward the success of the allied nations in the great war. He was also director of a corps of railway experts in Manchuria. From 1919 to 1923 he was president of the Interallied Technical Board supervising the Siberian railways.

Mr. Stevens was chief engineer of the Panama Canal from 1905 to 1907 and in 1907 acted as director of the Isthmian Canal Commission.

American Society of Civil Engineers Awards Four Medals and Prizes

Four prizes and medals were awarded during the session of the annual meeting of the American Society of Civil Engineers, held in the Engineering Societies Bldg., New York City Jan. 21. The awards and their winning papers are as follows:

Norman medal—Awarded to B. F. Jakobsen, consulting engineer, San Francisco, for his paper on "Stresses in Multiple - Arch Dams."

James J. R. Croes medal — Awarded to Joel D. Justin, Watertown, N. Y., for his paper entitled "The Design of Earth Dams."

James Laurie Prize—Awarded to C. M. Allen, professor of hydraulic engineering at Worcester Polytechnic Institute, and to I. A. Winter, for their paper entitled "Comparative Tests on Experimental Draft Tubes."

Arthur M. Wellington Prize—Awarded to Rufus W. Putnam, major, Corps of Engineers, U. S. A., and district engineer, Chicago, for his paper on "Modern Rail and Water Terminals with Reference to Chicago."

No award for the Thomas Fitch Rowland prize or the Collingwood prize for juniors was made.

B. F. JAKOBSEN, who received the Norman gold medal for his paper on "Stresses in Multiple-Arch Dams," is a consulting engineer with offices in the de Young Bldg., San Francisco, Calif. Mr. Jakobsen was born in Denmark in 1881, and was graduated as an electrical engineer from the Mittweida Technical Institute, Germany, in 1902. This was followed by a year at the University of Dresden. His professional career covers five years as junior and assistant engineer with the U. S. Reclamation Service on the Salt River and on the Elephant Butte project. On the former project his work covered design and supervision of construction. On the Elephant Butte project he was assistant to the chief designing engineer, working on the design of the dam and gates.

After leaving the then Reclamation Service, he was employed as electrical engineer in connection with the Cerro de Pasco Mining Co.'s hydro-electric power development in Peru and as designing engineer in connection with the Homestake Mining Co.'s hydro-electric development at Leads, S. D.

From May, 1919, to September, 1922, Mr. Jakobsen was designing engineer in charge for the San Joaquin Light & Power Corp., Fresno, Calif., having charge of the design for the Kerckhoff power development and the Kern River power development. Since September, 1922, he has been consulting engineer and as such has been employed by the Feather River Power Co., San Francisco, Calif., and in connection with the dams for the Los Angeles Flood Control District, which latter work he is now engaged upon. He is the author of numerous articles published in the technical press.

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JOEL D. JUSTIN, winner of the James J. R. Croes medal for his paper on "The Design of Earth Dams," was graduated from Cornell University in 1906, with a C.E. degree. After graduation he worked for the Pennsylvania R.R., then on the Cobbs Hill Reservoir at Rochester, N. Y. In 1917, he went with the New York Board of Water Supply as assistant engineer, first in hydrographic work and then in construction work, finally becoming section engineer in immediate charge of construction of the Olive Bridge Dam. After five years, Mr. Justin left the Board of Water Supply and went with James H. Fuertes. He was resident engineer on dams and water supplies, and was later Mr. Fuertes' principal engineer at Harrisburg and in New York.

Leaving Mr. Fuertes, Mr. Justin became successively identified with the Fargo Engineering Co. of Jackson, Mich., with which concern he was employed on a number of power projects, and as construction engineer of the Wissota hydro-electric project, and with the Aluminum Co. of America in immediate charge of the Yadkin Falls project and of preliminary investigations and studies for other work. Later he became chief engineer of the department of hydro-electric plants of the Sudlin Engineers, Inc., Winston-Salem, N. C., during two years of which time he was consulting engineer for the North Carolina State Board of Health.

In 1923 Mr. Justin became hydraulic engineer for the Power Corp. of New York, and has been engaged in studies and investigations for future projects of this company. At the present time he has three months' leave of absence from the company and is acting as consulting engineer to the Governor General of Formosa on a large earth dam which that government plans to build.

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RUFUS W. PUTNAM, Major, Corps of Engineers and district engineer at Chicago, was awarded the Arthur M. Wellington prize for his paper entitled "Modern Rail and Water Terminals with Reference to Chicago." Major Putnam was born at La Crosse, Wis., in 1891. He is a great-grandson of Gen. Rufus Putnam who built the fortifications at Dorchester Heights, Mass., and West Point during the Revolutionary War. Major Putnam was appointed to the U. S. Military Academy from Rushford, Minn., being an honor graduate in the class of 1913.

Upon graduation, commissioned as second lieutenant, he was first stationed at Washington Barracks, D. C., from which he was graduated in 1916. Prior to the World War he served with engineer troops at Washington Barracks, San Francisco and Vancouver Barracks, Wash., as second lieutenant, first lieutenant, and captain. During the early part of the World War he was in charge of the military survey section of the offices of the Chief of Engineers at Washington, D. C., later serving overseas as major and temporary lieutenant-colonel with the 318th Engineers. From Jan. 1, 1919, to June, 1921, he was executive officer at Camp Humphreys, Va., and in July, 1920, was commissioned major and assigned to Chicago as assistant to the U. S. District Engineer. That appointment was made in June, 1921, and in December of the same year he was made district engineer, maintaining that post continuously since.

* * *

CHARLES M. ALLEN, who, together with I. A. Winter, was awarded the James Laurie prize for their paper on "Comparative Tests on Experimental Draft Tubes," was born in Walpole, Mass., in 1871. He was graduated from the Worcester Polytechnic Institute in 1894 and since that date has been connected with the Institute, for the past 15 years as head of the hydraulic engineering department. In addition to his work at the Institute, Mr. Allen has carried on a consulting practice specializing in measurement of water and power.

Co-operating with Prof. George I. Alden of Worcester, Mr. Allen developed the Alden dynamometer in large sizes for measuring power and has used these machines for testing many power plants in the United States and Canada. Mr. Allen has made a continuous study of the various methods of measuring water and power and has conducted many researches for developing new and improved methods along these lines, the latest being the salt velocity method.

Testimonial to Former Secretary of Illinois Society

In appreciation of 21 years of service as secretary and then a year as president, the past-presidents of the Illinois Society of Engineers at its annual dinner in Chicago, on Jan. 16, presented a gold watch to E. E. R. Tratman, the retiring president. The presentation was made by Prof. A. N. Talbot, of the University of Illinois.

Almert Resigns Presidency of A.A.E. to be Manager

Drive Planned to Strengthen Interest of Chapters and Members—Change in "Professional Engineer"

An important change in the management and organization of the American Association of Engineers was made at the meeting of the Board of Directors on Jan. 9-10 at Chicago. Discussion of the general condition of the association developed the need for active field work to stimulate the interest of members and to strengthen chapter activities. During the past year this field work has developed upon the directors within their respective districts, but the results were inadequate. Because of this situation and the desired expansion of the work of the association in several directions, it was concluded that an emergency exists which calls for unusual and prompt handling. President Harold Almert was believed to be the best qualified field director, and therefore the position of Directing Manager of the association was created by the board. President Almert was engaged as directing manager, whereupon he resigned as president and was succeeded by the first vice-president, Morris Bien.

PROFESSIONAL ENGINEER CHANGES

Extensive changes in the association's journal, *Professional Engineer*, were forecast by the adoption of a resolution that the journal be published "as a magazine of general interest to engineers," and that the executive committee of the board be empowered to turn over the publication, if desirable, to a subsidiary publishing corporation, to be organized for the purpose of publishing *Professional Engineer* and rendering other publication services as may be found necessary.

Expansion of the employment service of the association was decided upon. The board, in a resolution, expressed its view that this is one of the most important services of the association, and that a branch office of the National Employment Service should be established in New York at once. It is hoped to establish another branch in the West, possibly in Denver, as the next step in expansion of this service.

Establishment of educational courses to provide extension education for engineers in fields outside their regular activity was strongly favored by the board. Preliminary steps were taken to utilize courses of study at some existing educational institution for this purpose.

Lower membership dues were considered desirable; the board in this respect approved the recommendation of the Committee on Amplification of Ideals and Objects, made last spring, favoring a decided reduction of dues. Accordingly the board expressed itself in favor of changing the system of membership payments by fixing the national dues at an amount between $6 and $7.50, and leaving it to the individual chapters to fix their local dues as they might require. A referendum of the membership on this recommendation was ordered to be carried out shortly.

June 2-5 was fixed as the time of the next convention of the association, to be held at Orlando, Fla. After the convention a "motorcade" will take the delegates for a week from Orlando as far south through the Peninsula as Miami, returning to Jacksonville.

Samuel Whinery Dies

The death of Samuel Whinery, consulting engineer, occurred on Jan. 15 at his home in East Orange, N. J. Mr. Whinery was one of the engineers who engaged in railway work in the period after the Civil War; later he became well known in many lines of engineering, including pavement construction, and during his many years of practice as consulting engineer he served on many municipal commissions.

Mr. Whinery was born in Salem, Ohio, in 1845. As he said in his reminiscences in the fiftieth anniversary issue of *Engineering News-Record*, with a common school education he began, in 1867, his studies and experiences in engineering at the rear end of a chain, on the location of a railroad about 75 miles long, in Indiana. He was engaged on railroad work until 1868; but two years, 1878 to 1880, were spent as U. S. assistant engineer on the improvement of the Tennessee River at Muscle Shoals and on other government works. On one railway, between 1881 and 1884, he employed the first telephone used in railway construction and train dispatching; he served on construction of the railway up Lookout Mountain. Having joined the Warren Scharf Asphalt Paving Co. in 1887, he was successively vice-president, general manager, and president, and designed and built the first self-propelling concrete mixer and the first railway asphalt paving plant.

Consulting civil engineering practice was undertaken in 1901 and continued until stopped by his last sickness. Of the many commissions which Mr. Whinery served, he was consulting engineer for the Finance Commission of Boston and the Commission on City Expenditures, Chicago, also to the president of the Borough of Manhattan in 1905. He was member of an engineering commission that made an important report on street cleaning and waste disposal in New York City.

In 1918 he was chairman of the state commission to re-appraise the railroads and canals of New Jersey and in the same year a member of the reserve examining board of the Bureau of Yards and Docks, of the Navy Department. Of the American Society of Civil Engineers he was director for three years, and vice-president from 1892 to 1894; he was at one time vice-president of the American Institute of Consulting Engineers and a member of the American Public Health Association and of the Academy of Political Science. His writings included a book, "Municipal Public Works," and a work on "Specifications for Pavements and Roads," and many magazine articles.

Engineering Council Meets at Washington

On Jan. 16 and 17 the annual assembly of the American Engineering Council was held at Washington. The main subjects of discussion were the activities of the Board of Jurisdictional Awards and the Department of Public Works. The Detroit Engineering Society opposed the continuance of a representative of the Council on the Board of Jurisdictional Awards, which is the body to arbitrate jurisdictional strikes in the building industry, but after a prolonged discussion the Council decided to continue to maintain its representative upon the board.

The following resolution regarding the Department of Public Works was adopted and $1,000 appropriated toward the promotion of the proposal:

"It is the sense of the meeting that the present proposed legislation should be amended in so far as the Department of the Interior was concerned so as to bring the bill into substantial accord with the principles embodied in the Jones-Reavis Bill as far as present conditions would permit."

Reforestation and timber supply were discussed and the attention of member societies called to the importance of the subject and the work of the recent conference on street and highway safety was endorsed. The remainder of the discussion was mainly concerned with the internal affairs of the Council.

On Friday evening a dinner was given under the auspices of the local engineers at the Chevy Chase Club at which the principal address was made by Gen. H. M. Lord, director of the Bureau of the Budget, and at which also Secretary Hoover made some few remarks. Mr. Hoover especially commended the work of the Council in its inauguration of the studies into waste in industry.

President James Hartness presided at the meetings of the Administrative Board on Thursday and Saturday. He was re-elected as president of the Council and A. W. Berresford, O. H. Koch and Dexter S. Kimball were elected as vice-presidents. L. W. Wallace was reappointed as secretary by the Administrative Board.

It was announced that the next meeting of the Administrative Board of the Council will be held in Philadelphia sometime in May.

Industrial Alcohol Co. Liable for Molasses Tank Collapse

Structural weakness is given as the cause of the failure in January, 1919 of a 90-ft. diameter molasses tank in Boston, Mass. (See *Engineering News-Record*, May 15, 1919, p. 974). The finding was made public last week by Col. Hugh W. Ogden the auditor of 119 suits brought in the Suffolk Superior Civil Court in Boston. The collapse of the tank resulted in the death of 21 persons, the flooding of cellars and the failure of a portion of the nearby elevated structure. A more extended account of Colonel Ogden's findings will be contained in an early issue of this journal.

Illinois Society Holds Big Annual Meeting

Prepared Discussions Successfully Supplement Papers Covering Wide Range of Subjects

Assigning a particular class of engineering work to each of six sessions, each presided over by an engineer specializing in that class of work, proved a very successful arrangement at the 40th annual meeting of the Illinois Society of Engineers, held at the Great Northern Hotel, Chicago, on Jan. 14 to 16. Another feature was the unusual amount of active discussion, due largely to restricting the number of papers for each session. The registration of members and visitors passed the 200 mark.

In the water-works section, the Chicago water supply system was described by M. B. Reynolds, engineer of design, and the control of its safety by A. E. Gorman, chief of the city's bureau of sanitary engineering, while Colonel Sprague, commissioner of public works, in his address of welcome, dealt specially with the problem of Chicago's excessive waste of water in relation to its supply, and the draft of water from Lake Michigan for the Chicago drainage canal and sewage disposal. Apart from these local matters, the effect of temperature and alum on hot-process water softening was discussed by A. M. Buswell, chief of the State Water Survey.

Sewerage and Surveying

The sewerage section had specialized on topical discussions of two subjects, with members assigned to prepare brief statements from different points of view. As to the relative value of combined and separate sewers, the former had the stronger support, for reasons of both design and operation. The other subject was on the operation of sewage-treatment works, in discusssing which Mr. Radebaugh, of Urbana, suggested two lines of activity for the operator, superintendent or chemist. In the first place he should put the cost of operation on a budget system for the several kinds of expenses; in the second place, instead of his monthly report dealing only with chemical analysis of the sewage, it should include condensed statements of expenses, notes on operation, repairs, new work, laboratory and operating record.

That the Illinois surveyors' licensing law has worked well, in spite of weak points in the law and obstacles put in the way of its operation, was stated by William Kramer, of the board of examiners. Under a population clause this law now applies only to Cook County (Chicago) and after much discussion as to whether a state-wide law is advisable it was decided that the society should work for such a law. Surveying as a profession was discussed by M. L. Greeley, and old government survey marks discovered in northern Wisconsin were described and shown by H. C. Hall, of Iron River, Wis. There was a paper by G. W. Stickney, city engineer of Wheaton, on the combined sewerage and drainage district organized recently at that city, where a neglected septic tank and house connections made to storm drains have resulted in unsatisfactory outlet conditions.

A new section for mechanical, mining, and electrical engineering, organized only a year ago, provided a good program which included radio, electric control systems, high-pressure steam, powdered fuel and the railway situation. This last subject was presented by R. H. Ford, assistant chief engineer of the Rock Island lines. Although the Illinois State Highway laboratory service is more extensive than that of any other state its expense is only ¾ to 1 per cent of the highway construction cost, according to a paper read at the highway session by H. F. Clemmer, testing engineer. Concrete and brick paving and the oiling of earth roads were also discussed. In describing the progress of the topographical mapping of Illinois, Mr. Leighton, chief of the Illinois Geological Survey, stated that 44 per cent of the state is now covered.

A. L. Webster, Wheaton, Ill., was elected president; L. J. Woltmann, Bloomington, Ill., vice-president; and H. E. Babbitt, Urbana, Ill., secretary.

Walbridge Elected Head of Associated Contractors

George B. Walbridge, vice-president of the Walbridge, Aldinger Co., general contractors of Detroit, has been elected president of the Associated General Contractors of America. The election was announced at the annual convention of the association held in Washington last week. Mr. Walbridge is a graduate of Lafayette College, receiving from that institution in 1898 a civil engineering degree. On the day of his graduation he enlisted in the Pennsylvania Volunteers, Battery "A" of Philadelphia as a private in the Spanish-American War, serving in Porto Rico. He was discharged in the fall of '98 and entered Cornell University, taking a post graduate course in mechanical engineering.

Leaving Cornell in 1900 Mr. Walbridge went to work for D. H. Burnham & Co., architects, Chicago, in the engineering department. He was with that firm as engineer and superintendent until 1905 when he joined John Pierce & Co., New York City, as building superintendent. After two years with that organization he joined the Hedden Construction Co.

Mr. Walbridge in 1909 became general superintendent of construction with the American Construction Co., Houston, Texas, leaving them to accept a position with George A. Fuller Co. as vice-president in 1910. For six years he remained with the Fuller company and in 1916 formed a corporation with Albert H. Aldinger.

In 1918 Mr. Walbridge was commissioned a major in the Engineering Corps and stationed at Washington, D. C. A few months later he was promoted to lieutenant-colonel in the Quartermaster Corps, Construction Division.

All Upland Water Suggested for Philadelphia

G. W. Fuller and Others Address Philadelphia Engineers—Mayor Endorses 100 Per Cent Metering

A modification of the 1924 or Mayor Kendrick engineering commission plan for securing a new water supply for Philadelphia, whereby Neshaminy Creek would be added to the proposed upland supply from Tohickon and Perkiomen Creeks and the Delaware as well as the Schuylkill River be abandoned, was suggested last week by George W. Fuller and endorsed by Joseph F. Hasskarl and J. Waldo Smith, all members of the commission. Fred C. Dunlap, a former chief of the Philadelphia Bureau of Water, and John W. Ledoux, a member of the 1920 or Mayor Moore engineering commission, opposed the 1924 recommendations and favored the earlier schemes which they had advised. Of two councilmen who took part in the discussion noted immediately below, one was emphatic in declaring that all Philadelphia must be treated alike, instead of part having upland and part a continuation of the Delaware River supply, while the other councilman seemed to favor the Dunlap plan. All this occurred during a presentation and discussion of Philadelphia's water supply problem at a meeting of the Philadelphia section, American Society of Civil Engineers, at the Engineers' Club of Philadelphia. Mr. Fuller stated that he made the suggestion as an individual, rather than as a member of the commission, and that it was in answer to a request by Mayor Kendrick for advice as to the proper action by the latter, in view of present conditions, including the mayor's declaration for 100 per cent metering and an indication by Council President Hall that $10,000,000 a year could be found for new water-supply works for the next ten years.

Modification Proposed

The modification proposed "would be practically the recommended water project No. 1 of the Water Commission" of 1924, said Mr. Fuller, "except that 170 m.g.d. would be derived from the Neshaminy watershed to take the place of the present Delaware River supply at Torresdale." Continuing, Mr. Fuller said:

"This would increase the total investment, including pressure tunnels, from $91,500,000 to $116,100,000, as stated in the report for Project No. 2. By using the present Queen Lane, Roxborough, and Belmont filters and omitting construction of the pressure tunnel, it would be feasible to defer more than $24,000,000 of this investment cost. This would in effect provide for Project No. 3 as stated in the report of the Water Commission, at an estimated cost of $90,700,000.

"Some months ago Mayor Kendrick announced that he was in favor of creating under the Department of Public Works a new Bureau of Water Supply for the carrying out of the approved program. This is a wise step because the present Water Bureau is fully occupied with the operation and maintenance of existing works with their

needed extensions and betterments. It is in line with what prudent business establishments would do under similar circumstances."

While endorsing the suggestion for use of the upper Delaware water in place of that from Torresdale Mr. Hasskarl stated: "In favoring the Neshaminy rather than the Torresdale intake, I do so not because the lower Delaware water is not fit to drink but purely because public sentiment is opposed to the lower Delaware and never would agree to it being included in the new plan. The water is just as good as that coming from the upper Delaware, however, and I would not favor abandoning the lower for the upper river."

Mr. Dunlap criticised the program for immediate universal metering when there is so much need for funds to provide a safer supply, and when, as he urged, meters would reduce the consumption 12 to 15 per cent. At the same time, he said he believed in universal metering. Although the modified plan suggested by Mr. Fuller proposes abandoning the Delaware, Mr. Dunlap repeated his former criticisms of the Delaware River water from Torresdale. For the years 1922 and 1923 Mr. Dunlap stated that pollution indexes for the two streams stood as 28 for the Delaware and 15 for the Schuylkill. He again repeated his recommendation that the entire supply be taken from the Delaware above Trenton and from the Neshaminy, the cost of which he estimates at $66,000,000.

J. Waldo Smith thought a city as large and rich as Philadelphia should be able to settle on a water policy and stick to it. Apropos of the Dunlap plans to go to the Delaware River above Trenton and the general agreement among various engineers, that the ideal plan would be to go to the upper Delaware or Lehigh—which seems to be barred by the immense cost—Mr. Smith agreed with Mr. Fuller that it seems a pity to pass by nearby sources from which a large volume of safe water can be had—the combined capacity of the three creeks is placed at 430 m.g.d.

Isaac Walker, general manager New Chester Water Co., came to the defense of the Delaware River as a source of supply, citing tidal and other studies of the Delaware made by him from the viewpoint of the Chester supply. He suggested that the Delaware River intake of the Philadelphia water-works be extended to a point three miles above Torresdale, where there would be no possibility of contamination from Philadelphia sewage. To this suggestion Mr. Hasskarl replied that the plan was considered by the 1924 commission and rejected because it would be open to the same sentimental objection, since the river above Trenton receives the sewage from Easton and Allentown.

In closing the discussion, Mr. Fuller, referring to allegations by Mr. Dunlap about the Schuylkill being worse than the Delaware, said that until 1924 the bacterial samples of Schuylkill water were collected from the Fairmont Pool, where sedimentation reduces the bacterial content. When proper comparisons are made, the Delaware River water at Torresdale is better.

Engineering Societies

Calendar

Annual Meetings

ENGINEERING INSTITUTE OF CANADA, Montreal; Annual Meeting, Montreal, Jan. 27-29, 1925.

AMERICAN WOOD PRESERVERS ASSOCIATION, Chicago, Ill.; Annual Meeting, Chicago, Ill., Feb. 3-5, 1925.

AMERICAN CONCRETE INSTITUTE, Detroit, Mich.; Annual Meeting, Chicago, Ill., Feb. 24-27, 1925.

AMERICAN RAILWAY ENGINEERING ASSOCIATION, Chicago, Ill.; Annual Convention, Chicago, Ill., March 10-12, 1925.

AMERICAN SOCIETY OF CIVIL ENGINEERS, New York City; Spring Meeting, Cincinnati, April 22-24, 1925.

AMERICAN WATER WORKS ASSOCIATION, New York City; Annual Convention, Louisville, Ky., April 27 to May 2, 1925.

AMERICAN SOCIETY FOR TESTING MATERIALS, Philadelphia, Pa.; Annual Meeting, Atlantic City, N. J., June 22-26, 1925.

The Milwaukee, Wis., Chapter of the American Society of Civil Engineers at its Dec. 17 meeting elected the following officers: T. C. Hatton, president; W. J. Sands and C. R. Weymouth, vice-presidents; H. E. Nicol, secretary-treasurer. C. E. Gruetsmacher, director. C. E. Grunsky, president of the American Society of Civil Engineers, read a paper on the problems of the Colorado River.

Personal Notes

J. H. ROACH, heretofore valuation engineer, New York Central Railroad Co., has been appointed chief valuation engineer, New York Central Lines, with headquarters in New York. George W. Kittredge will continue as heretofore, as consulting valuation engineer, New York Central Lines.

GEORGE W. FARNHAM, who has for a number of years called on college professors for the McGraw-Hill Book Co., New York, has been made manager of the educational department of that company. FRANKLIN B. HANLEY, recently instructor in geology, Washington University, St. Louis, Mo., has joined the staff of the McGraw-Hill Book Co. as traveling college representative.

CHARLES J. MURRAY has resigned as chief engineer of the Knoxville Iron Co. to become chief engineer of Worsham Bros., general contractors, Knoxville, Tenn.

C. A. BINGHAM has resigned as city manager of Lima, Ohio, to become city manager of West Palm Beach, Fla. His municipal engineering service began in 1901 as assistant city engineer in Elizabeth, N. J., and included later the posts of deputy city engineer in the same city, city engineer at Carlisle, Pa., and city manager at Norwood and at Waltham, Mass., and at Watertown, N. Y.

Obituary

FRED F. MORAN, secretary of the Advisory Board on Industrial Education of the Department of Education, New York City, and managing director of the Apprenticeship Commission of the New York Building Congress, died suddenly Dec. 31, 1924, in New York City, aged 42 years. Mr. Moran, born in Brooklyn, and having worked as a newspaper pressman, active in arbitration for improved conditions for that trade, went to Cooper Union and studied electrical engineering, at the same time continuing his work on the newspaper. In 1916 he was a member of the mayor's committee on Industrial Education which outlined an educational program for printing pressmen. From 1918 to 1920 he served with the Military Training Commission of New York State doing special work in prisons. In 1922 he was appointed to the Advisory Board on Industrial Education, and the next year to the position of managing director of the Apprenticeship Commission of the Building Congress.

LIEUT.-COL. FRANCIS R. SHUNK, who retired from the Corps of Engineers in 1920, died at Tucson, Ariz., Jan. 4. Col. Shunk was born in Harrisburg, Pa., and graduated from the Military Academy in 1887. During his long career he had charge of many important engineering projects in Oregon, Florida, New York, Minnesota, Pennsylvania, Massachusetts and the Philippines. He was stationed at Washington Barracks in 1902 and 1917 was made resident member, at Washington, of the Board of Engineers for Rivers and Harbors; previously he had been in charge of river and harbor work in the vicinity of Pittsburgh, Pa.

THEODORE BREWSTER, formerly a government research engineer and at one time a resident of Detroit, died Jan. 11 at his home in Perth Amboy, N. J., at the age of 40 years. He was a graduate of the University of Michigan. During the World War he was engaged in preparation of poisonous gases at government laboratories in New Jersey and he had undertaken another government project a short time before being stricken with a nervous breakdown five months ago.

FRANÇOIS SCHÜLE died at Zürich, Switzerland, on Jan. 4, at the age of 65 years. For many years he had been at the head of the civil engineering courses of the Federal Polytechnikum at Zürich. His work in the field of testing made him widely known, particularly his pioneer experiments in the field of reinforced-concrete beams.

M. AUSTIN BELCHER, former superintendent of sewers at Winthrop, Mass., died recently at the home of his daughter in Philadelphia, Pa., at the age of 72 years.

From the Manufacturer's Point of View

A Point of Contact Between Maker and User of Construction Equipment and Materials

Improved Equipment at Road Show—II

Details of Machines and Materials at Coliseum, Chicago, During Convention of American Road Builders' Association

Engineering News-Record Staff Report

THE first portion of the report of the Good Roads Show, held in the Coliseum, Chicago, Jan. 5-9, in connection with the twenty-second annual convention of the American Road Builders' Association was published in last week's issue of *Engineering News-Record;* the second, and concluding installment appears below:

Power Shovels

THE earth excavating equipment of the show ranged from the revolving power shovel to the light scoop loader operated by tractor power. Practically all of the shovels shown were of the ¾-yd. size on crawler traction. The power equipment included gas, steam, electric motors, and Diesel engines. There is a new maker in the field this year, Russell & Co. of Massillon, Ohio, which showed for the first time a ¾-yd. revolving crawler steam shovel.

Bucyrus Co., pioneer in the Diesel shovel field, showed one of its ¾-yd. high lift machines. The Marion was a steam machine with railroad type boom, although the company showed in addition assemblies of power equipment for its gas-electric shovels, in which there are three separate motors driven by a direct-current generator for the swinging, hoisting and crowding motions. On the Erie ¾-yd. steam machine there was a high-lift boom and a new dipper feature in the form of removable teeth involving no bolts or rivets; these teeth are of chrome manganese steel and are inserted into wedge shaped openings, the crowding motion of the dipper driving them firmly into place. On the Northwest gas shovel the principal new feature is the feather-touch control by which engine power is made to regulate the shifting of the clutches. The Koehring ¾-yd. shovel, which is interchangeable with a crane boom attachment, is substantially the same as last year's improved model.

The chief development of the year in the Thew shovel is the adoption of a center drive in place of an end drive for the crawlers; this drive is by means of gear and pinion with two jaw clutches. For the first time this year the Osgood Co. announced a Diesel powered shovel; the unit at the show, however, was a ¾-yd. gasoline machine with rope crowd. Another entrant into the Diesel-engine field as the power equipment for shovels is the Harnischfeger Corporation, which is prepared to equip its ¾-yd. revolving models with a 50-hp. Bessemer full Diesel three-cylinder engine, the weight of which is 7,600 lb. Convertibility from shovel to crane was featured by the McMyler-Interstate Co. on its ¾-yd. steam shovel; this machine has a worm-driven boom hoist and is designed to insure exceptional accessibility of parts.

Lighter machines than those above mentioned were the Keystone skimmer scoop mounted on half crawlers, the Byers skimmer, an attachment for the company's crawler crane, and the Hoar shovel developed originally for loading muck in mines and now offered for foundation and grading work; the latter shovel operates with very low headroom, the boom folding back on top of the machine.

For handling excavation which is not large enough to warrant investment in heavy duty plant, the Insley Manufacturing Co. featured a gasoline excavator rigged as a ½-yd. power shovel on crawlers and convertible into skimmer scoop, ditcher or crane.

Three different makes of light shovel or scoop loader, powered by Fordson tractors, were shown by Anthony, Mandt and Lessman.

Some Features of This Year's Road Equipment

Diesel-engine power shovels
Multi-purpose attachments
Light duty excavators and loaders
Gas engines in wide range of sizes
Bearing and lubricating refinements on concrete mixers
Improvements in portable compressors and pumps
New traffic signals and guides

Cranes

FOR the power shovel equipment noted in the preceding paragraph crane attachments may usually be substituted. In addition to the machines already mentioned, Harnischfeger showed a ½-yd. crane with a capacity of 3,500 lb. at 30-ft. radius. A 7-ton gasoline crane with 55-hp. engine and ¾-yd. clamshell bucket was featured by Orton & Steinbrenner; this machine is on a spring-supported crawler mounting. On the new ½-yd. Brownhoist combination crane and shovel, with rope crowd, the number of gears is only 18 as against about 30 on previous models; the power equipment is a 36-hp. gasoline engine. A one-piece openhearth steel base and a 7-ft. diameter bull gear were features of the 60-hp. Link-Belt gasoline locomotive crane with 35-ft. boom. This machine has a silent chain drive and a self-locking boom hoist drive; the gears total 18, of which 8 run in oil-tight casings.

A 28-ft. boom with a 16-ft. structural steel extension, giving a total length of 44 ft., was a feature of the truck-mounted crane made by the Universal Crane Co.; this high lift is useful in setting stone masonry or delivering concrete and other materials in building work. For the Byers "Bearcat" crawler-mounted locomotive crane with 40-hp. gasoline engine five attachments were exhibited, including crane, shovel, ditcher, skimmer with 12-ft. crowd, and backfiller attachment. The Speeder Machinery Co. showed its new light utility crawler-mounted crane weighing 18,000 lb. and providing two speeds on the drum and traction; this is a gasoline machine with 26-ft. boom operating a ½-yd. bucket. A model of its 45-hp. 30-ft. boom crane was shown by the Locomotive Crane Co. of America.

Draglines

A SMALL-SCALE model plant showing the operation of Sauerman power drag scrapers and slack-line cableways was in operation. This exhibit illustrated the use of the Crescent power drag scraper bucket. The company has produced a new roller bearing sheave requiring lubrication only once in 30 days. Other buckets for dragline work were exhibited by L. P. Green, specializing in the bottomless type with capacities of from ½ to 5 yd. and by the American Manufacturing & Engineering Co.

Trench Excavators

PARSONS showed one of its larger trenching machines built to cut to a width of 30 in. and a depth of 10 ft.; the developments in this machine include an improved boom hoist and crowding or stabilizing device. There is also a new patented digger chain without cotter pins. The Parsons backfiller with 30-ft. boom has a worm-gear swing and boom hoist; models have been developed for work in restricted places, such as alleys.

New buckets for varied trench widths were shown on the 35-hp. Barber-Greene vertical boom gasoline ditcher. The capacity of this outfit has been increased from a digging depth of 5½ to 7 ft. Features on the Austin trencher, designed for a 42-in. width and 15-ft. depth, included gearing operating in oil, powershift conveyor, and a standard automobile type of radiator on the 60-hp. gasoline engine. There was also on the floor an Austin backfiller with telescopic boom adjustable to lengths of 20, 25 and 30 ft.

A new backfiller was included in the exhibit of the Harnischfeger Corporation; in this unit the hoisting and dragging drums are independently mounted on separate shafts giving a center pull on the machine.

Representative of the lighter type of ditcher was the Topping "Pony" machine with Fordson tractor power, de-

signed for trenches 4½ ft. deep and from 17 to 20 in. wide; this trencher is convertible into either a side or center excavating unit.

Buckets

BUCKETS were both of the heavy excavating and lighter rehandling types in both clamshell and orange-peel designs. Blaw-Knox featured a new arrangement of lever arm sheaves and pins on its Dreadnaught; by a keying arrangement one of the sheave pins turns at half-line speed, reducing the relative motion between the bushings of the two sheaves, thus minimizing wear and allowing extremely large bearing area for each of the bushings. A new one-piece hinge construction and stiffener reinforcement on the inside of the bowl were features in the Owen ¾-yd. and 1½-yd. buckets. The Mead-Morrison clamshell in sizes from ½ to 3 yd. is bronze bushed and equipped for pressure lubrication and variable reeving from two to five parts.

An improved bucket was exhibited by the McMyler-Interstate Co. in ¾-2½-yd. sizes with adjustable counterweights; this unit for hard digging may be reeved with five parts of line, and for faster, easier work with three parts. The bucket hangs squarely when dumping and does not twist the holding line. In addition to its clamshell model, the Hayward Co. showed one of its small orange-peel buckets for removing material from within the restricted area of a pipe or foundation casing. Additional improvements in bucket design were shown by Haiss, with a lever arm clamshell designed so that the rope is reeved continuously in one direction, avoiding S-bends, by Williams with a ¾-yd. tandem sheave power arm unit, and by Erie and Inland.

Gasoline Engines

INTERNAL combustion engines are now available as the power plants for both light and heavy construction equipment. The exhibits offered a broad range in type and capacity. The limits were represented by the units of only one or two horsepower for driving small mixers or pumps and the engines of more than 100 hp. for power shovel and crane service. In some cases the engines were shown as individual power units and in others in combination with other forms of machinery, such as pumps, compressors, saw rigs, etc. In the larger sizes, Climax had a 120-hp. six-cylinder engine for use in cranes, shovels, and industrial locomotives, in addition to a four-cylinder unit of about 70 hp. and a 50-hp. tractor motor. At the Waukesha booth were 100-hp. units in four-cylinder and six-cylinder models and also a 75-hp. engine, all equipped with the Ricardo head and improved cylinder oiling devices.

In the intermediate sizes were the machines of the Novo Engine Co. ranging from 1½ to about 40 hp. and combined with hoists, pumps and compressors. The Buda exhibit included new four-cylinder and six-cylinder units designed especially for industrial use. Additional models were shown by Wellman-Seaver-Morgan, Beaver and Continental. Units of smaller size were represented by LeRoi, with a line from 3 to 15 hp., Hercules, Cook, with its Denison powermaker, Fuller & Johnson, with units of 1 to 25 hp., Universal Motor, with its new Flexifour industrial four-cylinder machine in 5-10-hp. capacities, Stover, Turner & Moore, and Alamo.

Gasoline engine accessory equipment was shown also by Hinckley Motors with its sliding gear replacement transmission for Ford cars and trucks, by the Twin Disc Clutch Co. and by the Cotta Transmission Corporation. The magneto exhibits included those of the Bosch, Splitdorf, and Eisemann organizations.

Concrete Mixers

THE mixer exhibits included sizes from small tub or tilting machines on two-wheel trailers to the big 21-E pavers on crawler treads, designed for rapid loading and discharge and meeting the new A.G.C. standards.

A new arrival in the large paver field was a machine designed by members of the Foote organization. On this model a number of refinements have been introduced in the form of eliminating grease cups by forced feed lubrication, by a liberal use of ball and roller bearings, oiltight housings for gears and shafts, and steel castings. On this model the engine is mounted at the front end of the machine and the mounting is on crawler tractors. The machine is not yet in production and no official rating has been assigned to it, although it is said to be of 28-cu.ft. capacity. One of the features is at the loading end, where, instead of the usual pivoted skip, there is a vertical hoist which raises a hopper to a point of discharge into a reserve batch bin, the latter being emptied automatically into the drum immediately after the batch is discharged. This feature is intended to cut down on the loading time by having a batch available always for immediate entry into the drum.

In addition to this new machine, the Foote company showed its standard 21-E paver which this year has been provided with larger charging and discharge openings, stronger crawler tread pins, and a loading skip which can work between forms on half width road construction. The Chain-Belt Co.'s 21-E paver was fitted with a batch-box derrick and a direct chain drive from gas engine to counter shafts. The mechanism of this unit has largely been inclosed and runs in oil baths. For municipal work requiring low clearance a folding top frame has been introduced. Improvements in the loading and discharge elements speed up these operations. The company has just introduced a new small mixer in the form of a 3½-cu.ft. tilter. The Koehring company showed its standard 21-E machine with batch-box derrick, self-spreading bucket and automatic balanced valve for water supply; on these machines, also, a low head frame is featured for city work.

On the Smith paver the power plant is now a 47-hp. gasoline engine and the frame height has been decreased to 11 ft. 3 in. for city work. The skip also has been redesigned to operate on halfwidth road construction without striking the forms. For bridge and culvert work two new small sizes of Smith mixer have been brought out, a 2½- and a 7-cu.ft. machine. No substantial changes have been made in the Ransome 21-E paver shown last year. An addition to the Ransome line, however, is a small 3½-S tilting mixer on four wheels.

On the Marsh-Capron 7-S machine a feed water pump has been installed. Refinements have been added in the form of disk wheels, rubber tires, roller bearings, and cushion springs. A track loader is featured on the 14-ft. machine of the Construction Machinery Co., while on the Lakewood 7-S machine discharge may be controlled from either side. A one-bag mixer mounted on a Ford one-ton truck constituted the feature of the Archer booth. A narrow drum and a reversible traction drive for sidewalk, curb, and gutter work were emphasized in the one-bag mixer of the Standard Scale & Supply Co. Other machines in the mixer exhibit were the Cropp, with a low charging design; Kwik-Mix on trailer mounting; Knickerbocker, with Timken bearings and Alemite lubrication; Leach with a varied line of large and small machines; American Cement Machine Co. with a 7-E alley paver; Republic with a small tub tilter in 6 and 10-ft. models; and Lauson.

In capacities of 5 and 14 ft. Wonder mixers were exhibited by the Construction Machinery Co. of America; an improved loader track extension can be fitted to either of these models.

Loaders and Conveyors

ON the Haiss path-digging bucket loader a new feature is a batch bin receiving the discharge from the bucket and delivering it in measured quantities. In addition to its standard bucket loader, Barber-Greene had working models, on a one-eighth scale, illustrating the unloading of sand from a railway car by means of a portable conveyor and its subsequent handling by an elevating bucket conveyor. Portable conveyors on two-wheel mountings were shown by Link-Belt, Burch Plow Works, Barber-Greene, and Northern Conveyor Co.

Bins and Batch Measurers

STEEP side slopes to reduce dead storage are new features of the Blaw-Knox hopper type bin for road-building materials. By recent alterations in design the company's batcher is made to serve both for measuring sand and larger aggregate, the only difference being a reducing collar for the sand batcher. The newer Erie storage bins also are fitted with steep sloping sides and the company's aggremeters have been made adjustable as to capacity, the limits for the sand device being from 6 to 13½ cu.ft. and for stone 12 to 24 ft. Improved interlocks have been incorporated in the Johnson demountable bins and new and improved weighing hoppers introduced. Folding

steel bins were featured by the Butler company.

Crushers

A COMPLETE portable crushing and screening plant was the principal feature of the exhibit of the Russell Grader Co. The Smith Engineering Works had two model plants in operation, one a crushing plant and the other a gravel-washing plant.

The Williams company showed two sizes of crusher, one for reducing 48-in. cubes and the other, of the hinged hammer type, for 16-in. cubes. Crushers also were exhibited by the Universal Crusher Co., while the Simplicity Engineering Co. displayed its oilless vibrating screen for wet, damp or dry materials.

Air Compressors

MANY of the mechanical refinments seen on machines of larger size were incorporated in the display of portable air compressors. These machines were all on wheel mountings, both steel rimmed and rubber tired for city work, and varied in displacement capacity from 90 to 310 cu.ft. of free air per minute. The new 220-ft. airplane model exhibited by the Sullivan Machinery Co. was a four-cylinder, 42-hp. gas engine unit with two cylinders set on each axis of the machine at an angle of 90 deg. to secure balance. Air valves on both inlet and discharge were of the wafer pattern. There was also shown a 110-ft. Sullivan compressor, a Turbinair portable hoist, and a variety of pneumatic tools, including concrete breakers, spaders, and rotator hammer drills.

At the Ingersoll-Rand booth the main features were a 310-ft. portable compressor powered by a 65-hp. gasoline engine and a smaller size, 90 ft., operated by an electric motor. In addition to the company's standard line of pneumatic tools was a new portable road surfacer in the form of a Jackhamer drill on a two-wheel mounting for bushing down uneven joints between old and new pavement sections. On the Buhl 90-ft. compressor hand oiling has been superseded by forced feed; a new 105-ft. machine has been designed for mounting either on rubber-tired trailers or a Ford 1-ton truck. Other features of this line are mechanical intake valves, vanadium steel valve springs, bronze-backed babbitted bearings, and dustproof wheel caps.

A novel design was shown by the Chicago Pneumatic Tool Co. in the form of a compressor driven by a 30-hp synchronous electric motor with stationary armature and revolving field, the latter serving as the flywheel of the machine. A crankshaft and connecting rod transmit power directly to the compressor cylinder without recourse to belt drive; starting and stopping are automatic. This machine is a recent addition to the company's line of compressors.

Fordson tractor power was employed to operate the compressors exhibited by Schramm, Inc. These are made in three sizes of 60, 100, and 120 cu.ft., and are mounted on a standard trailer frame designed also to receive other forms of equipment such as pumps, hoists and welding outfits; the company emphasized the interchangeability feature of this rig. On the Traylor compressor, made by the Cement-Gun Co., a feature is a supporting frame of pipe which acts as the air receiver. A 160-ft. portable unit operated by a 45-hp. gasoline engine was shown by the C. H. & E. Mfg. Co. Other compressors were those of the Domestic Engine & Pump Co., the O. K. Clutch & Machinery Co. and the Curtis machine belt driven from a Fordson tractor.

Hoisting Engines

ON THE 35-hp. gasoline two-drum hoist, exhibited by the National Hoisting Engine Co., the main features were the placing of brakes and frictions on opposite sides of the machine, a desirable feature in building operations where considerable lowering must be done, the provision of a hand throttle control, and a silent chain drive. The Mead-Morrison exhibit included a two-speed slack-line excavator hoist and an electric car puller of the capstan type. In the newer types of Mead-Morrison hoists with patent automatic brake, a constantly running motor is used, thus relieving the operator of the effort in starting and stopping the motor with each trip. In the high speed reversible single-drum field C. H. & E. showed a 35-hp. gasoline hoist giving a pull on a single line of 4,000 lb. at a rope speed of 200 ft. Concentration of levers and extension of the throttle lever to the operator's position for control in emergencies were features of the 50-hp. three-drum and swinger gasoline hoists shown by Clyde. The new Domestic two-drum gasoline hoist has heavy screw thrust and positive friction release.

For operating a bottomless dragline bucket there was a Beach double drum portable gasoline hoist mounted on a four-wheeled framework. As the drums are mounted in a line parallel to the longitudinal axis of the frame, side thrust during operation is provided for by a pair of knee braces. The design of this hoist provides for only one shift lever, one brake lever and one clutch pedal.

In the booth of the American Hoist & Derrick Co. were photographs of hoisting engines for locomotive cranes and for the company's new gasoline revolving shovel designed for grading and other excavation work.

Other varieties of hoist were exhibited by the O. K. Clutch & Machinery Co., L. P. Green, Standard Scale & Supply Co., American Manufacturing & Engineering Co., and Domestic Engine & Pump Co.

Previously Reported

Last week's installment of the Road Show Report covered developments in:

Road Graders	*Locomotives*
Rollers	*Motor Trucks*
Snow Plows	*Wagons and Cars*
Tractors	*Truck Bodies*

Other standard types of machines and materials are covered in this week's issue.

Portable Pumps

ROAD construction has been responsible for the development of a great variety of portable pumps ranging from the single diaphragm force pump to the powerful triplex unit capable of delivery through many miles of pipe line. All of the units shown were gasoline engine operated and carried by two-wheel or four-wheel trailer frame. The Novo line included single and dual diaphragm pumps, piston pumps, and centrifugals. Inclosure of operating parts was a feature of the Barnes triplex pump rated to deliver 60 gal. per minute against 500 lb. per square inch pressure. This unit is protected by a tamper-proof steel housing consisting of three sliding panels, engaged by a single padlock. The gear drive on the C. H. & E. triplex unit is inclosed and runs in grease. A special feature of the Humphryes single and dual diaphragm pumps is the easy removal of the valve by unscrewing a pair of nuts on two vertical guide posts. The Carter display included both diaphragm and force pumps, the former equipped with rubber ball valves. At the Domestic Engine & Pump Co. booth were both single and dual walking-beam diaphragm trench pumps; a new product is a short-stroke double-acting plunger force pump for high pressures that might rupture a rubber diaphragm, built in two sizes of 105 and 150 g.p.m.

Road Forms and Finishing Machines

MANUFACTURERS of steel road forms have had to produce equipment to insure concrete slabs with smooth, true surfaces. Specifications for the new McCormick Boulevard in Chicago require the removal of any slab that deflects ¼ in. For the Heltzel road rail the lock joint provides for stakes only 6 in. apart and insures a grip which prevents rail deflection. The Carr forms shown by Lakewood have a wedge lock joint and self-cleaning round top; they are built in 12-ft. sections from 6 to 9 in. high. Both road forms and curb and gutter forms were exhibited by the Blaw-Knox Co. and the Metal Forms Corporation, the latter showing in addition a sectionalized steel plate form for general building and wall construction. On the Hotchkiss road forms substantial support to the channel is afforded in each length by three stake pockets and two riveted strips giving support at 2-ft. intervals.

Finishing Machines — The concrete road finishing machines at the show included those of Lakewood, Dunn, Heltzel, French (the Ord machine). These units are driven by gasoline engines and perform the operations of striking off, tamping, screeding and belt finishing. The Lakewood machine has a new extension to adapt it to widths of 30 ft. for city street work. The Dunn machine may be utilized on half-width road construction.

Accessory equipment for finishing concrete roads consisted of a Macon roller and also a square wire mesh roller made by the Perforated Concrete Roller Works, designed to release air and water in the concrete mixture and produce a durable surface.

A new machine for constructing a longitudinal center-line joint in concrete pavement was featured by the Flexible Road Machine Co.; this device places a long V-shaped strip which is removed from the concrete after it was set and the groove filled with bituminous joint material.

Steel Reinforcement

FEATURING Havemeyer bars, the Concrete Steel Co. demonstrated how they are held in position prior to concreting a road slab by means of a new spacing and supporting chair and clips. For thickened edge concrete pavement reinforcement the National Steel Fabric Co. showed a system in which the outside bars were of larger diameter than those on the inside of the mat. At the Kalman booth was an illustration of the use, with that company's reinforcing steel, of double stirrups and bar trees. The Truscon Co., in addition to its wire mesh, showed the application of marginal bars to concrete road construction. Electrically welded fabric was displayed by the American Steel & Wire Co., while the Ryerson exhibit, in addition to triangle mesh and steel shapes, included that company's studded plates for preventing wear on wooden roadways of bridges.

The Godwin company demonstrated its straight, flangeway and corner steel guards for protecting concrete curbs and paving edges.

Guard Rails

IN LIEU of wooden guard rail at danger points along highways, there may be substituted either wire rope or wire fence barriers. For this purpose the Macwhyte Co. makes a three-strand seven-wire guard rail rope, while the Page Steel & Wire Co. and the Cyclone Fence Co. each produce a guard of interwoven wire fencing.

Aids to Traffic

FOR controlling and directing vehicular traffic on streets and roads the show contained a number of devices in the form of plain and illuminated signals and signs. An elaborate display of electric light signals on both pedestal and bracket mountings and flashing beacons was made by the Crouse-Hinds Co. Other electric apparatus was shown by the American Gas Accumulator Co., Macknel Signal Corporation, Griswold Safety Signal Co. which supplemented its electrically lighted equipment, protected by special sun shades, with an automatic police traffic whistle, Adams & Westlake, the Esco Manufacturing Co., with directional signals and mushroom lights, and the Automatic Signal & Sign Co. Plain traffic direction signs, street names and signs carrying route numbers of state highway systems were shown by H. J. Andrews and the Union Iron Products Co.

For painting traffic lines on pavements the Tennessee Tool Works exhibited a new compressed-air spray machine with oscillating paint tank and adjustable guides at each side of the brush to control the width of the painted line between 3 and 8 in. A device of the same general sort was found at the booth of the Simmons Paint Spray Brush Co.

As distinguished from these painted lines, the Flexible Road Machine Co. exhibited apparatus for producing a permanent white cement traffic line in concrete pavements, described in this journal Jan. 1. The Signs of Safety Co. displayed tile lettering for insertion in paved surfaces.

Street Sweepers

A NEW motor pick-up street sweeper, formerly controlled by the Buffalo-Springfield Roller Co., was displayed by the Kinney Manufacturing Co. Its features are a pair of rotary gutter brooms on each side, a central moldboard, a steel pick-up broom, and a traveling belt conveyor delivering into a closed compartment, the whole being mounted on a motor truck chassis. Provision is made also for sprinkling in front of the brush. The Elgin pick-up sweeper has one flexible gutter cleaning rotary brush on each side, a spray, and a pick-up broom which clears a path 10 ft. wide. The latter company also makes an auto-eductor, a motor-truck-mounted device with two-stage centrifugal pump for removing detritus from sewer catchbasins.

Pipe and Steel Castings

FOR culverts the American Casting Co. produces a spirally corrugated cast-iron pipe jointed by screwing one section a short distance into the other. Rust-resisting culvert pipe was exhibited by the Armco Culvert & Flume Manufacturers Association and by the Klauer Manufacturing Co.

For conditions of severe service such as crawler track shoes, bucket teeth, gears, pinions, sprockets and rollers, a number of types of alloy steel castings were featured by the following firms: Hadfield-Penfield, Gerlinger, American Manganese Steel Co., American Malleable Casting Association, Sivyer.

Bituminous Pavement and Equipment

PRODUCERS of asphaltic and bituminous materials for road-construction use were well represented at the show. Their exhibits consisted in most cases of typical cross-sections of pavement construction and samples of material. Among those represented were the Texas Co., Barrett Co., Barber Asphalt Co., Asphalt Association, Kentucky Rock Asphalt Co., American Tar Products Co., Warren Brothers Co., Hastings Pavement Co., National Pavements Corporation, Amiesite Co., Asphalt Block Pavement Co., and Lewis Mfg. Co.

Heating and Mixing Plant—Equipment for asphalt and bituminous pavement construction included the pressure distributors of the Good Roads Machinery Co., an 800-gal. tank on a 5-ton GMC truck, the Etnyre Co., also with 800-gal. capacity and equipped pump driven by separate gasoline motor, and Charles Hvass & Co. An asphalt heater was shown by the Macleod Co.

Prominent among the asphalt mixing equipment exhibits was the self-contained Mosher patch plant on rubber tired trailer mounting with a capacity of 700 sq. yd. of 2-in. sheet asphalt in 10 hr., manufactured by the East Iron & Machine Co. This organization also displayed a model of its Merriman asphalt plant mounted on a railroad flat car. Portable plants in four sizes were featured by F. D. Cummer & Co. In its literature the company described its one-car steam melting asphalt plant built in sizes with a guaranteed capacity of 2,200 yd. of 2-in. sheet asphalt per day of 10 hr. A bituminous heater was exhibited by the Headley Good Roads Co.

Expansion Joints—Built-up expansion joints of bituminous material for use in concrete pavement construction were shown by Carey with its Elastite products with rectangular strips and irregular shapes for curb and gutter work, by the Servicised Products Co. which manufactures a bituminous crown on a center-line plate, and by the Hoosier Asphalt Co.

Concrete Pavements

THE Portland Cement Association, as usual, had an exhibit illustrating improved methods of concrete road construction. The American Vibrolithic Corporation featured construction service for its pavements which are consolidated by gasoline-engine-driven vibrating equipment operating on wooden mats. Alumina cement, possessing properties which develop high strength in concrete in 24 hours, was featured by the Atlas Lumnite Co. Improved methods and equipment for making concrete blocks were shown by the Ideal Concrete Machinery Co.

For the rapid curing of concrete roads, the Dow Chemical Co. illustrated uses of Dowflake, a calcium chloride product which is applied to newly finished road surfaces by means of a two-wheeled trough with adjustable openings in its bottom for controlling the sifting of the material onto the surface. Another use for the Dow product is found in the maintenance of earth and gravel roads, where the hygroscopic properties of the calcium chloride are valuable for preserving the surface and eliminating dust.

Unclassified Exhibits

EXHIBITS which do not fall under the classifications previously considered include the following: The Dot high-pressure lubricating system of the Carr Fastener Co.; the Bangert chip spreader for road maintenance work; tile pipe of the Clay Products Association; paving brick by the National Paving Brick Manufacturers Association; loadometer or portable weighing device for motor trucks by Black & Decker; tool branding iron by the Everhot Manufacturing Co.; wrenches by the Snap On Wrench Co.

In addition, there were shown Racine radiators; Celite products; a Thomas mowing machine; Cleveland Pneumatic Tool Co. air springs for trucks; Alan Wood studded steel traffic plates for reducing wear on wooden bridge floors; Conneaut hand shovels; the Handy

sack baler; the Concrete Surfacing Machinery Co.'s Berg electrically operated surface finisher; Milburn portable carbide lights and welding and cutting equipment; Tinius Olsen testing machines and laboratory equipment.

A compact, lightweight, powerful jack operated by oil on the hydraulic cylinder and hand-pump principle, built in capacities of 2, 5 and 10 tons, was shown by Otto Bieber & Co.

The McKiernan-Terry Drill Co. demonstrated its piledriving hammer by a unique small-scale working model handled by a miniature Mundy electrically driven hoisting engine. This unit put down small-scale Lackawanna steel sheetpiles in a box of molding sand and pulled them up again by means of reversing the hammer and using a yoke.

At other booths were seen Fruehauf trailers; Jones Superior rip and crosscut saw rigs; Lufkin rules; Sweets rails and track equipment; and motor truck parts by Service Motors, Inc. The Pittsburgh Testing demonstrated its facilities for the control and inspection of asphaltic materials.

An attractive educational exhibit was made by the U. S. Bureau of Public Roads illustrating sound principles of highway finance, construction, and maintenance.

Business Side of Construction

FACTS AND EVENTS THAT AFFECT COST AND VOLUME

How the Contractor Sees 1925

The following is in reply to a letter from *Engineering News-Record* regarding the construction situation in various parts of the country and the outlook for the coming year:

"It is generally conceded that the volume of work contemplated for the year 1925 will be above normal and particularly is this true in road work. All bond issues brought forth by the various states in the Union have passed with the exception of one—Kentucky. The states that have not passed bond issues are pointing their way either to a bond issue in the very near future or to some form of taxation which will take the place of a bond issue. The state of Illinois is leading the Middle West with a program of fifteen hundred miles for the year 1925. Other states in this territory will increase their expenditures over that of 1924. The Eastern States, Pennsylvania having been held back somewhat during the fall in letting her 1925 program, will undoubtedly make up for lost time after the first of the year. New York is already letting larger contracts than ever before. Generally speaking, with the passing by Congress of a road appropriation of fifty-four million dollars in excess of that of 1924, it can fairly be assumed that the paving program for 1925 will be greater than of any year that has gone before.

"With this huge program before us and with the general trend of construction work increasing rather than decreasing, and with industry as a whole generally pointing toward an era of prosperity, there can be only one result and that is the decrease in supplies, materials, equipment and labor available because of an increased demand for all of these various items which are absolutely essential necessities in the carrying out of a paving program.

"In addition to the fact that labor will be in demand, it has been our experience that when the demand for labor increases in the industrial sections, that absorbed by the paving industries become inferior in quality and numerically inadequate. All of these things will result in a constant turnover of inexperienced labor and a general increase in the cost of production.

"Together with the above difficulties, will come the problem of bidding for your competitor's labor. This form of bad practice should be opposed and discouraged strongly by the Contractors' Association.

"During the past season, we have experienced the wettest for paving construction that we have ever known. This can be illustrated from facts taken from three of our contracts in the East—one extending over a total of 98 possible working days of which 35 were lost totally or partially on account of bad weather; on another project covering a period of 196 possible working days, 56 of these days were lost partially or totally and on a third project covering a period of 212 possible working days, 62 days were lost partially or totally, due to bad weather conditions. It can be generally stated then, from our past experience, that approximately 30 per cent of the possible working days are affected seriously by bad weather during a construction season. A factor which so strongly monopolizes the time of the contractor cannot be ignored without disagreeable results, and therefore when estimates are built up on future work, real money should be covered in the estimate to take care of just the conditions described in the foregoing — otherwise the so-called profit dwindles even to the point of becoming a loss." A. E. HORST,
Secy-Treas.
Henry W. Horst Company
Rock Island, Ill.

THE CONSTRUCTION SITUATION IN THE AGRICULTURAL DISTRICTS

The following is in reply to a letter from *Engineering News-Record* regarding the construction situation in the agricultural districts:

"It is a pleasure to write that the construction outlook for this locality is particularly good. There are not many large projects settled upon, or even contemplated, but the multitude of smaller ones show that this section will continue to advance.

"This, Lonoke County, will build at the county seat, a one hundred and fifty thousand dollar court house. The contract will probably be let next Spring. The legal proceedings have been completed.

"The people have had a taste of concrete roads and with the improvement of the farmer, they will demand more. Several small road projects are being agitated and may be settled upon at any time. Likewise with drainage. While no large drainage contracts are contemplated, much work will be done in the way of correcting or intensifying drainage in the old drainage districts.

"This being an agricultural section, the farms supply most of the labor. Since the migration of the negro we have been short of common labor, the price of which has continually increased and my opinion is that it will continue so throughout the year 1925."
OSCAR KOCHTITZKY.
England, Ark.

PREDICT RISING MARKET DURING EARLY PART OF YEAR

The following is in reply to a letter from *Engineering News-Record* regarding the construction situation in Pittsburgh, Chicago, Cleveland, Spokane and other sections of the country:

"The outlook for construction work in 1925 I believe to be reasonably good. In view of the election of Mr. Coolidge, business conditions have been stabilized and much work which has been held in abeyance will be undertaken.

"I believe, however, that work taken during the early part of 1925 will be on a rising market and a contractor bidding on work at that time should take into account the fact that labor costs will be higher even though wages may not advance. Materials prices may be expected to stiffen also. This ought to be taken into account in considering the cost of doing work during 1925."
W. A. ROGERS,
President.
Bates & Rogers Construction Co.
37 W. Van Buren St., Chicago, Ill.

Prices of Drain Tile in Illinois—1893 to 1924

The trend of clay drain tile prices during a 20-year period was noted at the recent meeting of the National Drainage Congress, in Chicago, by J. W. Dappert, Taylorville, Ill., who presented tables of actual prices for tile of various sizes in his locality for the 32 years 1893-1924, inclusive. The accompanying table is summarized from the more extended originals. For laying tile, the price is for an average depth of 4 ft. in ordinary soil and includes trenching, laying and backfilling.

DRAIN TILE PRICES IN ILLINOIS PER M.FT.

	Common Drain Tile			Vitrified Drain Tile		Laying 8-In. Tile Drains,
	6-In.	8-In.	12-In.	16-In.	24-In.	Per Rod
1893	$24	$40	$95	$200	$500	$0.48
1906	26	44	115	250	580	.58
1910	27	48	100	250	550	.65
1914	28	49	110	280	610	.74
1917	45	80	115	280	650	.68
1918	50	88	165	370	750	.88
1920	62	105	250	550	1,197	1.25
1921	77	125	300	489	1,100	1.11
1922	70	125	260	500	985	1.20
1923	50	90	280	450	1,075	1.00
1924	50	90	275	435	957	.92

Large Projects In Prospect

The following represent just a few of the big engineering construction jobs on which bids are asked or will soon be called for. Further details are given in the Construction News section of this issue, pp. 39 to 48.

Proposed Work

Water-works, Toronto, Ont., R. C. Harris, engr., $14,000,000.

Paving, Corsicana, Tex., bond election planned, $6,000,000.

Bridge, Pittsburgh, Pa., Allegheny County, $3,771,000.

Power development, Saluda, N. C., Blue Ridge Power Co., $3,500,000.

Office building, Miami, Fla., P. J. Davis and associates, $2,500,000.

Stadium, Philadelphia, Pa., Simon & Simon, archts., $2,000,000.

Railway, 40-mi., C. N. R. R., Ontario, Canada, $2,000,000.

Sugar Refinery, Winnipeg, Man., Dyer Co., Cleveland, $2,000,000.

Finishing plant, Asheville, N. C., Sayles Finishing Co., $2,000,000.

Sewers, Milwaukee, Wis., 1925 budget includes bonds for $2,000,000.

Road work, Jackson, Miss., bond election Jan. 29, $2,000,000.

Hotel, St. Louis, Mo., local syndicate, $2,000,000.

Bids Wanted On Big Jobs

Bridges, over Arthur Kill, N. Y. & N. J., J. A. L. Waddell, New York City, engr., $12,000,000.

Office building, St. Louis, Mo., Skouras Bros., $2,300,000.

Paper plant, Madawaska, Me., Fraser Companies, $1,000,000.

Excavation and piling, San Francisco, Calif., Army & Navy Y. M. C. A., $1,000,000.

Large Contracts Let

Office building, New York, N. Y., to Thompson-Starrett Co., $12,000,000.

Loft, Los Angeles, Calif., to Scofield Eng. & Constr. Co., $1,905,000.

Weekly Construction Market

THIS limited price list is published weekly for the purpose of giving current prices on the principal construction materials, and of noting important price changes on the less important materials. Moreover, only the chief cities are quoted.

Valuable suggestions on costs of work can be had by noting actual biddings as reported in our Construction News section.

The first issue of each month carries complete quotations for all construction materials and for the important cities. The last complete list will be found in the issue of January 1, the next on February 5.

	New York	Atlanta	Dallas	Chicago	Minneapolis	Denver	San Francisco	Seattle	Montreal
Steel Products:									
Structural shapes, 100 lb.	$3.34	$3.90	$4.15	$3.10	$3.35	$3.07½	$3.00	$3.35	$4.25
Structural rivets, 100 lb.	4.25	4.45	4.75	3.50	3.75	4.65	5.00	3.75	6.00
Reinforcing bars, ¾ in. up, 100 lb.	3.24	3.40	3.38	2.60@3.00	3.25	3.97½	3.35	3.25	4.00
Steel pipe, black, 3½ to 6 in. lap, discount	—48%	54 2%	43%	56½%	54 25%	36%	44.7@55 5%	45%	59.49
Cast-iron pipe, 6 in. and over, ton	54.60@55.60	56.00	56.00	47.20@48.20	55.50	62.00	53.00	65.00	60.00
Concreting Material:									
Cement without bags, bbl.	2.50@2.60	2.35	2.05	2.10	2.42	2.84	2.31	2.65	1.80
Gravel, ¾ in., cu.yd.	2.25	1.90	2.38	3.00	1.65	1.90	2.15	1.50	1.25
Sand, cu.yd.	1.25	1.40	2.00	3.00	1.25	1.00	1.50	1.50	1.25
Crushed stone, ¾ in., cu.yd.	1.85	2.00	2.38	3.00	1.75	2.50	2.15	3.00	2.25
Miscellaneous:									
Pine, 3x12 to 12x12, 20 ft. and under, M.ft.	+60.00	34.00	56.00	55.00	39.75	39.75	29.00	26.00	60.00
Lime, finishing, hydrated, ton.	18.20	22.50	20.00	20.00	23.00	24.00	22.00	24.00	21.00
Lime, common, lump, per bbl.	2.50@3.00	1.45	1.85	1.26	1.35	2.70	1.60	2.80	10.50
Common brick, delivered, 1,000.	18.00	10.50	11.60	12.00	15.00	12.00	14.50	14.50	17.50
Hollow building tile, 4x12x12, per block	Not used	.1004	.0941	.06	.07	.085	.....	.11	.12
Hollow partition tile 4x12x12, per block	.1162	.1004	.0941	.06	.....	.085	.108	.11	.10
Linseed oil, raw, 5 bbl. lots, gal.	1.18	1.26	+1.30	1.25	1.27	1.40	1.24	1.12	1.11
Common Labor:									
Common labor, union, hour.	.75	.30	.....	.82½	.....	.50@.55	.55	.62½	.....
Common labor, non-union, hour.	.....	.25	.30@.50	.75	.50@.55	.35@.50	.50	.50	.25@.30

Explanation of Prices—Prices are to contractors in carload lots unless other quantities are specified. Increases or decreases from previous quotations are indicated by + or — signs. For steel pipe, the prevailing discount from list price is given; 45-5% means a discount of 45 and 5 per cent.

New York quotations delivered, except sand, gravel and crushed stone, alongside dock; common lump lime, in 280-lb. bbl. net, and hydrated lime f.o.b. cars; tile "on trucks"; linseed oil and cast-iron pipe f.o.b.

Labor—Concrete laborers' rate, 93½c.; building laborers, 75c.; excavating laborers, 62½c. per hr.

Chicago quotes hydrated lime in 50-lb. bags; lump finishing lime per 180-lb. net. Lumber, sand, gravel and stone delivered on job.

Minneapolis quotes on fir instead of pine. Brick, sand and hollow tile delivered. Cement on cars. Gravel and crushed stone quoted at pit. We quote on brown lime per 180-lb. net; white is $1.60 for Kelly Island and Sheboygan. Common labor not organized.

Denver quotes on fir instead of pine. Cement "on tracks"; gravel and sand at pit; stone on cars; lime, brick, hollow tile and lumber on job. Tile price is at warehouse. Linseed oil, delivered in wooden bbl. Common lump lime per 180-lb. net.

Atlanta quotes sand, stone and gravel per ton instead of cu.yd. Common lump lime per 180-lb. net.

Dallas quotes lime per 180-lb. bbl. Steel, cement, cast-iron pipe and crushed stone f.o.b. cars, other materials delivered.

San Francisco quotes on Heath tile, size 5½ x 8 x 11½. Prices are all f.o.b. warehouses except C. I. pipe, which is mill price plus freight to railway depot at any terminal. Common lump lime per 180-lb. net. Lumber prices are to dealers in yards at San Francisco, for No. 1 fir, common.

Seattle quotes on Douglas fir (delivered) instead of pine. Lump finishing lime per 180-lb. net. Brick and hollow building tile delivered. Hydrated lime in paper sacks. Sand and gravel at bunkers.

Montreal quotes on pine lumber. Sand stone, gravel and lump lime per ton. Stone, lime and tile are delivered; sand, gravel and cement on siding; brick f.o.b. plant; steel and pipe at warehouse. Hollow tile per ft. Cement price is in Canadian funds (the Canadian dollar stands at 99.56). Bag charge is 80c. per bbl. Discount of 10c. per bbl. for payment within 20 days from date of shipment. Steel pipe per 100 ft. net; 3½-in., $59.49.

Conditions Affecting the Market

Prices of all commodities continue to show an excess of advances over declines. Building materials, after having followed a gradual upward trend since the latter part of November, are now less firm.

Certain of the paint materials offer exceptions to the general tendency. Linseed oil, continues higher; red and white lead, dry and in oil, advanced 1c. per lb. during the week.

While pine lumber prices show few fluctuations, there is a decided firmness evident in Douglas fir timbers.

Since the middle of January, advances in cement have occurred in various cities of the Middle West. The following centers report rises of 10c. per bbl.: Chicago, Indianapolis, Milwaukee, Peoria, Davenport, and Cincinnati. Cedar Rapids prices are up 6c. and those in Toledo 9c. per bbl.

Considerable improvement is noted in the unemployment situation which developed recently in the Northwest. Telegraphic reports to *Engineering News-Record* state that building and highway construction and also power development are gaining in volume in the Pacific Northwest.

There is increasing demand in the current market for such items as: steel shapes, bars, fabricated structurals, timbers, dimension lumber, sheathing, flooring, brick, cement, aggregates, glass, putty, paint and various roofing materials. This growing demand has not yet resulted in any marked increases in prices of these materials.